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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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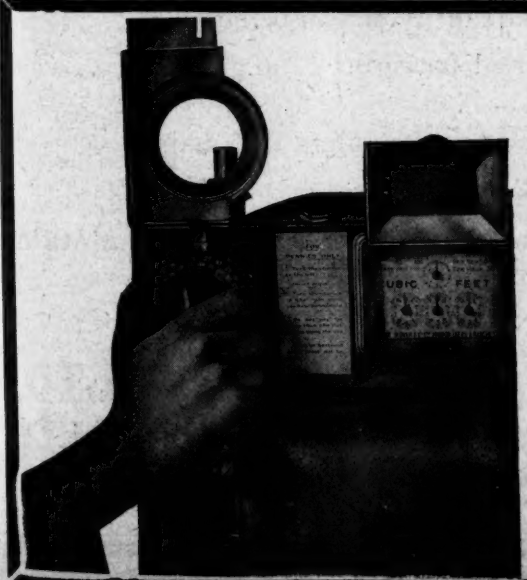

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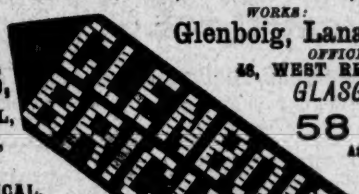

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EDITORIAL NOTES.

National Gas Council and the Work of Unity.

THE strength of the National Gas Council increases; its influence shows no abatement, but a robust growth; and those who are the keenest observers of the trend of general developments realize that the potent work of the organization in the past will be as requisite as ever in the future, particularly for defensive purposes. The National Gas Council is, in fact, the largest, and therefore the most influential, embodiment of unity ever existing in the gas industry. "Great things," said the President (Mr. D. Milne Watson) at the annual meeting, "have been achieved by unity; "still greater things will be achieved if this unity is main- "tained." The first part of the statement is confirmed by facts that are now embraced in the history of the industry; the second part shows a firm faith in unity. "Greater "things will be achieved if this unity is maintained." There must be no "if" in the matter. The unity must be maintained; and we say this very emphatically, viewing the unstable times in which we live. There is a gratifying feature about the report to which the President did not in his speech call attention, but which shows that there is a deep-set endorsement in the industry as to the views of what unity has accomplished, and as to what it will still accomplish in both defending and advancing the interests of the industry. The report tells us that there are now 828 gas undertakings in the membership, representing 89·1 p.ct. of the gas supply of the United Kingdom. A year ago the figures were 691 undertakings, and 88·3 p.ct. of the gas supply. These figures are interesting, eloquent, and gratifying. The gas supply represented has only increased by 0·8 p.ct.; but the number of undertakings has been enlarged by 137. This indicates that there has been a remarkable influx of the smaller undertakings into the membership; and this recognition by the smaller concerns of the work of the Council and of the value of unity is something over which all must rejoice who have the best interests of the industry at heart.

The past year has been one of extraordinary difficulty, through the coal strike, the bringing into operation of the Gas Regulation Act, and many other matters that have called for representation and action by the supreme organization of the industry. The report shows how extensive has been the work that has been involved; and the Chairman's speech discloses, without expressly saying so, how stressful and anxious at times have been the conditions which have had to be shouldered by those upon whom falls the chief burden of conducting the appropriate work, and representing the interests, of the constituent undertakings collectively. The coal strike disfigures the year with its monstrous ugliness. It was a temporary, but never forgettable, crisis; and it has left heavy financial burdens behind it for gas undertakings, as a result of their patriotic action to the country and community, the austerities of whose lot during the three months of strain would have been infinitely worse had it not been for the spirited manner in which the industry, despite consequences, worked for the maintenance of the supply of gaseous fuel. The gas industry to-day, or a large part of it, is labouring under a sense of injustice over this matter. It was a national trouble, the burden of which should not press on one section of the community more than upon another. Upon the gas industry it has fallen very harshly; and, in connection with its work in ameliorating the conditions of those months, the Government has refused it restitution even of the money spent upon foreign coal in excess of what would then have been the cost of British coal had there been no strike. The President fears there is no possible chance of getting the Government to change their decision, though an excellent —indeed, unanswerable—case was presented. The attitude of the Government was simply *non possumus;* and so the industry has to find what satisfaction it can in the fact that as a public utility service it never stood so high in public estimation as it does to-day. This is also apparently the view of the President; for he positively said that he did not think there would be any use in raising hopes of getting money back from the Government. But though the Council failed in securing the sought-for act of justice, the whole industry knows how deeply indebted it is to the activities during that time of the Council in working for the placing at the disposal of gas undertakings such coal as became available, and in assisting in the formation of co-operative purchase schemes in certain districts.

The bringing into operation of the Gas Regulation Act has caused the Council a substantial amount of work. There have been the inquiries into pressure, carbon monoxide, and incombustibles, in connection with which the Institution of Gas Engineers has worked hand in hand with the Council. The proceedings are fresh in memory; the gratification from the results continues, for they retain for the industry freedom in economic development. The year, too, has witnessed a considerable application for Orders under the Act, and a large yield. In the making of applications, the officers of the Council have rendered immense service to several of the applicants in helping them to construct the necessary schedules. In the examination of the applications and the mass of data they have involved, in forming decisions, and in issuing Orders, the Director of Gas Administration (Mr. H. C. Honey) has done something that is monumental to his industry and energy. This must be confessed by everyone who regards the work from the practical standpoint, and does not allow self-interest to obscure vision. Up to the end of September, 101 Orders had been issued, excluding a number of Special Orders, which means of obtaining additional powers are becoming very popular. By the end of the year, estimates place the output at something approaching 200. The President expressed the satisfaction of the industry over this no mean achievement. But there are gas undertakings that are grumbling over the "delay" (they call it) in dealing with applications. They forget the nature of the work. They ignore the fact that even the Director of Gas Administration is not superhuman. Those who grumble might not have accomplished nearly so much as he has done in dealing with the applications. There is something, however, to be said for their concern over their own interests. Financial conditions are not now so severe as they were; and the Board have to fix the standard or maximum price per therm "with such addition as appears to the Board reason- "ably required in order to meet the increases (if any) due "to circumstances beyond the control of, or which could not "reasonably have been avoided by, the undertakers, which "have occurred since the 30th of June, 1914." The late comers now fear they will not get the same terms as the early comers. If this were so, it would be distinctly unfair, in view of the loss of seven years in dividends and market values. It would be unjust that a matter of time should place one undertaking and one set of investors in an inferior position to undertakings and investors more fortunate in the matter of time and in position in the ranks of applications. It will take many years to compensate for the losses of the past seven, even if dividends are able to creep above pre-war ones, and before the war they were on the upward trend. Here, again, the Council steps in; and the President has promised that every effort shall be made to see

whether some arrangement cannot be come to whereby companies who have not yet got their Orders will not be prejudiced. A letter is also to be addressed to the Board to ascertain whether anything can be done to expedite matters. Of course, all the time that applications are hung-up, the unfortunate share and stock holders of the companies concerned are still bemoaning their fate in respect of the miserable dole allowed them by the Temporary Increase of Charges Act, and the low place in the market estimation of their stocks as desirable investments.

Those are the two principal matters that have engaged the attention of the Council and headquarters during the year; but the catalogue of other matters shows convincingly that there has been no time cut to waste. For information as to the nature and position of these other matters, the report of the proceedings at the annual meeting (published in later columns) must be consulted. In the report it will be remarked that the President had prematurely arrived at the conclusion that it was time he vacated his position in the organization, and handed it over to another. The Executive Board and the members generally for the first time found themselves unanimously in opposition to the President; and so he remains in office. They have done well. The President has served the industry truly, diligently, and skilfully. Though his Company is big and strong enough to fight alone, the Governor is a firm believer in co-operation, in presenting a solid front, in the policy of helping one another where interests are common, and, therefore, in the strong helping the weak. Moreover, he is at the very centre of activity, and, combined with being *persona grata* in all places, his qualifications include a capacity and willingness to serve. This is not the time to allow him to inaugurate a list of Past-Presidents of the National Gas Council. The future looks brighter; but in the years ahead there is careful watching to be done, quick decisions will have to be made, and prompt action will have to be taken.

Size of Coal and Carbonizing Capacity.

THE question of the influence of size of coal upon the rate of carbonization and the heat required for the purpose is receiving more attention now than was formerly the case. The matter is revived by the Presidential Address which Mr. H. Tindale delivered last October to the New South Wales and Queensland Gas Institute. The address contains several interesting topics—corrosion in gas plant, for example—in addition to the one in which we are specially concerned at the moment; but its publication has for convenience to be deferred for a week. The effects of size of coal in carbonization appear to require thorough investigation, in order to obtain definite information, as it seems clear that the effects attributable to size vary with the physical characteristics of coal. There is, too, the difference in conditions when plain carbonization is proceeding and when carbonization is supplemented by steaming. In ordinary carbonization, again, size of coal affects throughput, plant capacity, and fuel consumption for heating purposes. When dealing with carbonization only, experiences in different places in this particular matter are in the main much alike—even though the distance be that between London and Australia.

In his recent paper before the Institution of Gas Engineers on horizontal retort working, Mr. G. M. Gill made reference to the subject of coal size, though he did not go very deeply into it. In horizontal working at the Old Kent Road, he has found great variations in the weights of charges; and these variations, it has been ascertained, have an important effect upon results. He has discovered as much as 20 p.ct. difference between maximum and minimum weights of the charges. Size of coal is one reason for this; and the South Metropolitan Gas Company's practice is now to work to a standard of 97 p.ct. of the coal passing through a 2-in. square mesh. That is as far as Mr. Gill goes. Other investigations carry us beyond these particulars.

The important part that the presence of large and small coal has in a charge (as will be seen when we publish the address) is also alluded to by Mr. Tindale. Small coal, in this instance, is defined as that part which passes through a ¾-in. screen; while the large or best coal is that portion which is retained on the same sized screen. It is well known that heat transmission is much slower in retorts charged with fine, compact-lying coal, and that this requires a longer period for carbonization than larger coal, if complete carbonization is desired. This retardation of carbonization naturally affects the throughput of a retort, and the amount of fuel required for the work. It is on these points that Mr. Tindale is most interesting. In his experience, much less gas is made from a ton of small than from a ton of large coal; and in horizontal settings, the heats are much upset by the former. He also asserts that in vertical retort working the effect of small coal is detrimental, in view of the reduction of throughput. This other observers may say should be qualified by whether or not carbonization is accompanied by steaming, when "output" should be substituted for "throughput;" for, of course, the higher to which steaming is carried, the lower the throughput of coal. The best steaming results some engineers assert are obtained with an open charge—through which the steam can distribute itself instead of being blocked in the centre, with the result that passage is only possible *viâ* the incandescent part near the retort surface. On the other hand, others declare, as did Mr. E. Gillett, of Bradford, recently, before the Yorkshire Junior Association, that overall better results are obtained from small than from rougher coal, because with the small coal there is more time-contact between the steam, coke, and carbon to produce good water-gas results. With the rough coal, the steam gets away without being decomposed. That is Mr. Gillett's point of view. There is another aspect of it to which reference will be made in the final paragraph. But the point is one that requires thorough experiment with different types of coal.

There is no question, however, that in carbonization only, if it is effectually carried out, the character of the coal in respect of fineness or roughness has an important bearing on throughput, gas production per ton, and fuel used. Mr. Tindale, for example, tells us that, at the Mortlake station of his Company, the throughput in one installation of vertical retorts may vary within two or three days from 720 tons per day for large coal to 640 tons for small. There is a difference there of 80 tons, or a reduction of rather more than 11 p.ct. If this less throughput went on at the same rate day by day, it would mean an enormous difference to carbonizing capacity in a year—a difference on a 300-day basis of 24,000 tons. Further information on the point is given by Mr. Tindale. He tells us that over twelve months the daily throughput of coal has been compared with the percentage of large and small coal carbonized, and the weight per cubic foot of crushed coal supplied to the retorts. It has been found that, as the weight of coal per cubic foot increases—the increase in the percentage of small coal present in the mixture—the throughput decreased in the order of approximately 2 p.ct. for every 1 p.ct. in the weight per cubic foot of coal used. As to horizontal working, he points out that a charge of crushed large coal, equalling 13 cwt., is usually carbonized in twelve hours; but the same volume of small coal, weighing 14·5 cwt., is not only far from being carbonized in this time, but the additional weight necessitates extra heat. Thus uniformity in weight of coal per unit volume is an important factor in practical working conditions.

It is therefore submitted by Mr. Tindale that since the total quantity of gas made per installation is greater with large coal, it follows that in practice the tendency should be to carbonize large coal in vertical retorts. Opposed to this we have Mr. Gillett's point as to better results being obtained when steaming with small than with large coal. Though the small may act as a check, and give better time contact between steam, coke, and carbon, there is the fact that, transmission of heat being slower with the small material, this would offer facilities for steam getting away undecomposed, and assisting in still further retarding heat transmission. Dr. Geoffrey Weyman was recently dealing with this subject. He showed, among other things, how the transference of heat to the interior of charges is most rapidly effected by the gas evolved, and how the larger the particles of coal, the less continuous would be the plastic layer, and so the more rapid the carbonization. When the coal contains all sizes, the more irregular the mixture, the better the results. There is a critical size corresponding to the maximum rate of carbonization for each coal—the diameter of the retort being fixed. Every coal differs in respect of its maximum rate of carbonization.

There is much interest attaching to this subject of size of coal in respect of carbonization; and it is a study that, under his own conditions, every gas engineer can take up from every point of view to which attention has been drawn in this article.

Gas-Lamp Progress and Scientific Application.

QUITE recently, Mr. W. J. Sandeman was dilating in a valuable paper, before the Southern Association of Gas Engineers and Managers, upon policy, organization, and methods in gas trading, and on the necessity for the technical, as well as the commercial, education of those engaged in the business of selling and applying gas to the multifarious purposes—domestic and industrial—for which it is now used. The necessity for this is manifold; but in the main it may be condensed into realizing for the consumers the highest efficiency and economy, which means for the gas undertaking greater stability of business, and a value exceeding any other method of advertising and popularizing the staple commodity of the industry. The importance of technically educating the sales staff is well illustrated by a further paper of which Mr. Sandeman is the author, and some of the data for which were supplied by his assistant (Mr. W. A. Bishop). The paper was read last week before the Illuminating Engineering Society, and was on "Pro-"gress in Gas Lighting in Relation to Illuminating Engi-"neering." In this title readers will see a depth of meaning by considering the first four words in conjunction with the last five. It implies that, although good progress has been made in gas lighting, the progress cannot have full effect without utilizing it in a scientific manner; and this demands the technical education of those who have to deal with lighting. And those who have to deal with lighting are the same men who are called upon to do business in other gas-consuming appliances—industrial and domestic. The paper shows the need at the sales end of the higher education that has been so freely advocated of late, and especially in lighting, for no secret need be made of the fact that it is there the pressure of competition is greatest, but the pressure is least felt where the work of gas lighting is scientifically conducted. This is obvious from the testimony that comes from different districts. In some, gas holds its own well in lighting; in others, where rule-of-thumb gas-sale methods are among the "diehard" practices, electric lighting is making deep inroads into this branch of the business.

This one direction in which the paper will be very useful is in proving that efficiency in application is an essential in the lighting business, and efficient application can only be made by efficient men. It is not as though the gas industry has not good lighting instruments with which to prosecute the business. It has. The paper shows it—by tracing the developments in burners and lamps from the flat-flame stage to high-pressure lighting, and in indicating how, in both high and low pressure lamps, various aids to efficiency have been incorporated. Indeed, if comparison be made between the old-style and new-style incandescent gas-burners and lamps, the progress in efficiency and economy is almost startling. But to make the most of this progress (too much insistence cannot be placed upon this), it is very necessary that lighting should be dealt with by qualified men. Reading the paper, it is seen that there is little that electric lamps can do that gas cannot do as well, and that efficiently and economically. The paper might well have gone further than it did had not Mr. Sandeman, or rather his deputy, Mr. Bishop (the author being indisposed), been standing on a neutral platform; for from the point of view of quality of light, diffusion, and comparative lowness of glare, gas stands out well from the defects of electric lighting in its modern forms. We will not traverse the progress in burners and lamps, or the advances in the application of what is now known as "illuminating engineering" to gas lighting—a study that was very much neglected in the gas industry, and is now only developing by the force of circumstances and intelligent business policy.

But there was a great deal said, both in the paper and the discussion, as to the development of cluster lights—a development not only in use, but in efficiency. This is not something new; but it marks an advance which those who have studied the matter believe will be carried to a still higher efficiency to the further advantage of low-pressure work. These cluster lamps are now being widely used. They are of the multiple burner type, fed by the gas-air mixture through one burner tube, so that one gas and air adjustment deals with the whole cluster, thus promoting uniformity of incandescence of the mantles composing the cluster. Superheaters are provided which send the mixture to the point of combustion in a preheated state. Then in these clusters small inverted mantles (No. 2) are employed, instead of large ones. The advantages are several. There is greater efficiency from a lower consumption of gas. The mantles being of smaller size, they are filled with flame; and this also contributes to equal incandescence. They have greater strength than the larger mantles; and the longer life beneficially affects the cost of maintenance. The steadiness of the light is also greater. With them 30 to 35 candles per cubic foot is readily realized; and some makers put efficiencies as high as 40 to 45 candles per cubic foot. The paper testified well of them. Speakers in the discussion did likewise. Experience of them in streets, on bridges, and in shops and factories is uniformly satisfactory. In fact, these cluster lamps are displacing old types, and their competitive value is high. A great deal was said, too, as to the value and popularity of vitreosil ware for incandescent burner use.

One other point should be referred to; and we hope attention will be paid to it. It is a point that was made last week in dealing with the subject of gas-engine efficiency. There is a wide divergence now between town gases in respect of calorific value per cubic foot; and it would be more appropriate therefore if readers of papers would quote efficiencies at so many candle power per 1000 B.Th.U., or as Mr. J. G. Clark expressed it at per "centi-therm." "Centi-therm" as an expression of value might not do for the public; but it might become a term which could be adopted in our discussions and literature. Any way, we ought, for the sake of accuracy, to get away from quoting efficiencies at per cubic foot. To an extent this is meaningless, or insufficiently explicit, to-day. Of course, gas composition also has an effect on flame temperature; nevertheless, candle power per 1000 B.Th.U. or centi-therm is now something more definite and intelligible than candle power per cubic foot.

No Compulsory Smoke Abatement Legislation.

THE only conclusion to be drawn from the final report of the Departmental Committee on Smoke and Noxious Vapours Abatement is that the time is not ripe for legislation to compel smokeless domestic chimneys, though the harm, waste, and expenditure involved in the burning of crude bituminous coal are recognized to the full. It is a good thing the inquiry has been held; but the negative result of the reference as to advice regarding practicable steps to diminish the evils arising from the emission of smoke and noxious vapours leaves progress in this matter to the intelligence of the community and to those whose business it is to deal with smokeless heating. As a matter of fact, the gas industry, the electricity industry, and low-temperature carbonization people do not want a sudden revolution in this matter. It would cause considerable embarrassment, and so perhaps it is better progress should be made, at any rate for a time, along normal lines. Gas (the most convenient and economical of labour-saving agents) is at a high price just now; and electricity is prohibitive, so far as the masses are concerned, for any heating purpose, though the Committee recommend that both gas and electricity undertakings should be encouraged by the Government to cheapen their commodities, and that the practice of many municipal authorities of overcharging for gas and electricity in order to relieve the rates should be discontinued. This is good; but definite action by the Government to that end would be better.

As to smokeless solid fuel produced by low-temperature carbonization, it is mentioned that the Committee have been in consultation with the Fuel Research Board, who are of opinion that, till the engineering, technical, and economic aspects of the process have been continuously tested, it is impossible to determine to what extent this particular method would contribute to the solution of the problem in which the Committee are concerned. The low-temperature question appears to be an interminable one. The general feeling, apart from the low-temperature enthusiasts, is well represented by Sir George Beilby, when he says in a letter to "The Times" that the Fuel Research Board would, in respect of low-temperature carbonization, hesitate to put forward any economic estimates; their position being that so much remains to be done on the technical and engineering sides that the only wise course is to concentrate all available skill and energy on this side of the subject till the present experimental stage has been successfully passed. It cannot be too widely understood by the public that, in the opinion of the Board, this stage has not been reached by

any of the proposals referred to, or at H.M. Fuel Research Station. We do not know whether this includes the new rotary retort system.

Another point is that it is not a matter for self-congratulation to find that the comparative cleanliness of the atmosphere of German towns is found by the Committee to be due to the "intelligent" co-operation of all parties in applying to the work of heating non-smoke-producing methods. This reflects upon the intelligence of the people in this country; and perhaps in this particular matter, if not in many others no less important, the reflection is justified. It is intimated in the report that gas is more widely used in German factories than here, yet we have been priding ourselves upon the advances at home in this direction. But so far as the domestic use of gas is concerned, we give in this country a decided lead to Germany. While the Committee do not think it practicable to propose legislation dealing with smoke from private dwelling-houses, they are decidedly of opinion that control might be usefully exercised over the heating of new buildings other than dwelling-houses, as well as over smoke-producing industrial processes. The Committee also recognize the rapid extension that is being made in the use of gas for heating purposes; and they recommend that in large buildings central heating should be applied, supplemented by gas or electric fires. The inclusion of electric fires must be with a view not to wound unnecessarily the sensitive feelings of the electrical advocates of this form of heating; for the Committee, or certain members of it, must know that electric heating is not a national economy, but is a greater waster of thermal energy than the burning of crude coal direct in a fire grate.

Christmas and the New Year.

To our readers and all business connections, the old-time wish slightly varied—"The Merriest of Christmases, and may the New Year bring a Full Measure of Happiness and Prosperity to All."

Summer Time.

While talking of Christmas, a few words as to "summer time." The Government have arranged with France and Belgium that the daylight saving period shall commence on the night of the last Saturday in March (or the last Saturday but one in March when the last Saturday is the day preceding Easter Day), and end on the night of the first Saturday in October. Legislation will be submitted to Parliament to give effect to this. It will be a convenience to have our "summer time" coinciding with that of our neighbours.

Acumen in the Gas Business.

A Superintendent of a Gas Distribution Department, in making some complimentary remarks upon the editorial under the above heading in our issue of Dec. 7, as well as upon Mr. Sandeman's paper before the Southern Association, writes that he feels sure "all leading distribution men will welcome such views, so well expressed, upon so important a subject; for indeed one finds competition much keener now than before the war. . . . It is only with such well-expressed views that we distribution men will be able to 'keep our powder dry.' I am not at all satisfied that the gas industry is adopting a bold and sufficiently aggressive attitude, when we consider that we have a very good and reasonable priced article to sell. In other words, 'our light is too much under a bushel.' However, one realizes that your 'JOURNAL' is rendering yeoman service. It is up to us to carry out two well-worn war mottoes: 'Deliver the goods,' and 'Get a move on.'"

Fuel Blending.

In an article on "Fuel Economy," the Engineering Correspondent of the "Daily Telegraph" refers to the successful trials that have been made with the methods of fuel-blending. For example, in one case a mixture of three parts of coke breeze and one part of washed singles gave an evaporation in excess of that obtainable by the washed singles alone. Whereas coke breeze of 10,000 B.Th.U. gave an evaporation of 5 lbs. and the washed singles with 13,000 B.Th.U. gave 7 lbs. steam per pound of fuel, the mixture referred to gave evaporation tests on two trials of 7·16 lbs. and 7·13 lbs. This is largely in excess of what might have been anticipated by any law of averages. The coke contained 9·3 p.ct. and the coal 33·2 p.ct. of volatile matter. It was evident that the coal burned alone gave off unconsumed hydrocarbons. The mixture with coke breeze, however, gave a volatile content suited to complete combustion in the boiler, with the beneficial result referred to.

Gas Coal Position.

In most of the coal areas—Yorkshire and Derbyshire especially—there has been a good inquiry and firm buying of gas coals for the purpose of increasing stocks to carry over the Christmas and New Year period. A slackening-off in output and delivery may be expected. From some quarters, the report comes that there is less gas coal now on the open market, and greater recourse is being had to contract supplies. There is no doubt gas-works are providing excellent outlets for coal just at the present time, when there is so much stagnation in other directions. This, however, so far as home gas-works are concerned, does not apply to Durham and Northumberland, the reports from which areas state that there is little doing in gas coals for home use, but export business is expanding. This applies to all sorts; and some of the colliery owners who have had a very bad time (some have lost a large amount of money this year) are beginning to feel that revival of a business on a profit-making basis has actually begun

PERSONAL.

The new Deputy-Governor of the Gas Light and Coke Company (in place of the late Mr. H. J. Waterlow) is Mr. JOSEPH LISTER GODLEE, who became a Director upon the amalgamation of the West Ham Gas Company with the Gas Light and Coke Company in 1909.

We are informed that Mr. J. N. REESON, who has for some years past occupied the position of Engineer-in-Chief to the Metropolitan Gas Company of Melbourne, has now been appointed Engineer-in-Chief and Technical Adviser to the Company.

Prof. H. B. DIXON, C.B.E., M.A., M.Sc., Ph.D., F.R.S., has intimated to the Council and Senate that it is his intention to retire from the Sir Samuel Hall Chair of Chemistry at the end of the present session. He was appointed to the professorship in 1886, in succession to Sir Henry Roscoe. As "JOURNAL" readers are well aware, Prof. Dixon's special line of research, in which he is recognized as the leading authority, has been the investigation of the rate of explosion in gases. It was his knowledge and experience of this branch of investigation which led to his appointment in 1891 to the Royal Commission on the Explosion of Coal Dust in Mines, and also to the post of Deputy Inspector of High Explosives for the Manchester area during the war.

At a recent meeting of the Directors of the Sutton (Surrey) Gas Company Mr. HENRY GAGE was appointed Engineer and Manager, in succession to the late Mr. Stephen Carpenter. Mr. Gage served under Mr. Henry Morley, at Cardiff, and was afterwards appointed on the engineering staff under Mr. H. D. Madden, the present Engineer. Since August, 1915, he has held the posts of Assistant Works Manager and Works Manager at the Gillingham station of the Rochester, Chatham, and Gillingham Gas Company, and during the last three years has been in his present position of Assistant Engineer and Manager to the Company. Mr. Gage holds the full Technological Certificate of the City and Guilds of London Institute in "Gas Engineering," was first Bronze Medallist in 1912, and has certificates in "Advanced Engine Design," and "Building Construction," taken at the Cardiff College.

Mr. JOHN P. THOMSON, Gas Manager at Tillicoultry, has been appointed to a similar position at Newmilns, Ayrshire.

Señor JOSÉ CABESTANY, City Engineer of Barcelona, is on a visit to London, and last week inspected the street lighting of the Metropolis, under the guidance of Mr. W. J. Liberty.

Mr. WILLIAM PHILLIPS, the eldest son of the late Mr. William Richards Phillips, has succeeded to his father's position as Engineer, Manager, and Secretary of the Luton Gas Company. Mr. Phillips's grandfather—the late Mr. William Phillips—held the position until his death in 1889, when he was succeeded by Mr. Richards Phillips who passed away a few weeks ago. Like his father before him, Mr. William Phillips (who is the eldest son of the family) did not serve his early apprenticeship in the works of the Luton Gas Company. Following a private education, he was a pupil for five years in an architect's office in London, and was then trained by his father at Luton in general engineering and gas and water engineering. In due time, Mr. Phillips became his father's right-hand man, assisting him in all his important work. Since his association with the Luton Gas Company, Mr. Phillips has been appointed Consulting and Supervising Engineer to the March Gas Company, and in the same capacity to the Ampthill Gas Company. He was also appointed Consulting Engineer to

the Hitchin Urban District Council and Rural District Council for their water supply works. Now he has succeeded his father as General Manager, Engineer, and Secretary of the Luton and Stevenage Gas Companies.

OBITUARY.

WILLIAM THOMSON.

With painful suddenness, the death occurred early last Friday morning of Mr. William Thomson, Engineer and Manager of the Ramsgate Gas and Water Department. It was, however, known to his friends that his health was very seriously affected. As a matter of fact, he had been in failing health for some years, chiefly owing to the strain caused by the duties and responsibilities cast upon him by the war, when he remained in charge of the works, and had to bear the shock on Oct. 31, 1917, when the Ramsgate Gas-Works were partly destroyed by German aeroplanes. He was at his home in Montefiore Avenue when the midnight raid took place; and upon hearing the bombs on the works, nearly a mile away, he rushed there. A bomb had dropped near the purifiers; and though the German raiders were still overhead, Mr. Thomson bravely scaled a ladder, to replace some plugs that had been blown out. This led to the commencement of a serious illness. Last Thursday he was at the works as usual, but during the afternoon was taken ill. He was removed home, and lapsed into a state of unconsciousness, from which he never recovered. Deceased was about 47 years of age, and leaves a widow and one daughter, with whom deep sympathy will be felt in their bereavement, the painfulness of which was much accentuated by the fact that controversy had been taking place in connection with the gas and water undertaking.

Though born in Edinburgh, Mr. Thomson was only a year old when he went to Inverness with his father, who was the first Manager of the Inverness Gas-Works under the Corporation. Mr. Thomson served his articles in the Engineering Department of the Highland Railway Company; and on the completion of his term, he spent a considerable time in the workshops of Messrs. Alder and Mackay, of Edinburgh, where he acquired a knowledge of the construction and testing of prepayment meters. Afterwards he was appointed Assistant Engineer and Manager, under his father, at the Inverness Gas-Works—a position that he held for three years. Early in 1899, he became Chief Assistant and Deputy Engineer and Manager, under Mr. George R. Hislop, at the Paisley Gas-Works. In September, 1902, he was selected to follow Mr. T. N. Ritson at Kendal, on the removal of this gentleman to Ramsgate, in succession to Mr. W. A. Valon. At Kendal, Mr. Thomson fully sustained his credentials as a thoroughly qualified engineer and manager. By close personal supervision in all departments, and by economies effected by judicious foresight, he increased the surplus profits, and enabled the Committee to reduce the price of gas. Until 1907, he retained the position of Gas, Electricity, and Water Engineer to the Kendal Corporation; and then, on Mr. Ritson's resignation, he succeeded him at Ramsgate, in the position which he thus held for a period of fourteen years. Mr. Thomson was a prominent Freemason.

The funeral takes place to-day (Wednesday), at St. Lawrence Cemetery, Ramsgate.

Supplying Carbon Dioxide to Greenhouses.

The Germans are undertaking to increase the growth of plants by increasing the supply of carbon dioxide in the air by other means than the provision of decaying carbon. Writing on the subject in the "Gas-Age Record," Mr. W. D. Wilcox, of Idaho, says it appears to be well established that the rate of plant growth increases with additions to the carbon dioxide in the air up to a maximum proportion of about 6 p.ct. When considered as a practical proposition, the means by which the carbon dioxide is obtained, and its cost, are matters of primary importance. The products from the burning of coal under ordinary conditions are of somewhat doubtful utility. For the carbon dioxide enrichment of the air of greenhouses, no more convenient or dependable means can be found than to burn gas in open-flame burners within the greenhouse. Thus the heating and the supply of carbon dioxide can be accomplished in one operation and at one expense. Where natural gas is sold at the low price per 1000 c.ft. still prevailing in many fields, it may be regarded as an economical means of greenhouse heating, independent of any bye-product value gained from the carbon fertilizer released when the gas is burned. The cost of artificial gas, however, being considerably higher, and its heat value per 1000 c.ft. less, it may be necessary, in order to justify its use in place of coal for greenhouse heating, to show a substantial advantage in the increased growth of plants by reason of carbon fertilization. The experiments in Germany would indicate that a substantial advantage is realized. The results are such as to justify the manager of a gas company in proposing the use of gas for heating in every greenhouse within the area covered by the distribution mains. If the existing means of heating by steam-pipes are retained for extreme cold, the demand of the greenhouse for gas will not vary widely during the period of perhaps seven or eight months that artificial heat is required.

A GAS INDUSTRIES DIRECTORY.*

Produced by the Society of British Gas Industries.

WHEN the Society of British Gas Industries take a job in hand, they do it thoroughly and well. We have had evidence of this on many occasions; and an addition to it is supplied by their innovation in producing what will henceforth be known as the "Society of British Gas Industries Directory." Perhaps some explanation of the reasons for the production of this fine volume, and a statement of its aims, should be presented.

The members of the Society have recognized a difficulty to which their clients and customers are exposed by the usual method of sending out individual catalogues. All purchasers of equipment, appliances, or supplies have experienced the difficulties which are attendant upon the use of manufacturers' catalogues for reference purposes, caused by the variety in their sizes and shapes, the difficulty in filing and indexing them; also the differences in arrangement of the catalogues, and so on. In other countries (in the United States especially), and for some few trades in this country, an attempt to minimize these difficulties has been made by the issue of a general catalogue for a particular trade or industry, containing the condensed catalogue data of the various firms which go to make up that trade or industry. These general catalogues present to buyers systematically arranged information, indexed and cross-indexed, so as to be readily available for reference.

In the early part of 1921, a proposal to issue such a standardized directory or catalogue of the gas plant and appliances manufactured and supplied by the members of the Society was brought before the Council; and, after careful consideration, it was decided that the Society should undertake a publication of this character. The compilation of the directory was placed in the hands of the Secretary (Mr. Arthur L. Griffith); and the following Committee was appointed to supervise its publication: Mr. J. Bridger; Mr. Frederick G. Cockey; Mr. Samuel Cutler, Jun., Assoc.M.Inst.C.E.; Mr. Cyril G. Davis, M.I.Mech.E.; Sir Arthur Duckham, K.C.B., M.Inst.C.E., with Mr. G. Hutchins, C.B.E., acting as Secretary to the Committee.

Now we have the result before us. The directory is intended to contain, in a condensed and standardized form, the catalogue data of those manufacturers of gas plant and appliances who are members of the Society, supplemented by a classified index of equipment, supplies, and materials. In effect, its aim is to provide within the covers of a single book, in a readily available form, information now contained in numbers of individual catalogues. The general scheme of the book is that the announcement of each firm shall, as far as possible, contain a brief statement of its products, equipment, or materials, or the services offered; and condensed particulars of the main items of its manufactures, giving a description of the equipment and material supplied, sizes stocked, capacities, efficiencies, properties, advantages, &c., and any other information of interest to prospective users. The directory also contains the text of the Standard Specifications for Refractory Materials and the Standard Conditions of Contract adopted by the Institution of Gas Engineers; certain of the specifications issued by the British Engineering Standards Association selected as being of special interest to the gas industry; and a number of useful engineering formulæ and tables. The work will be a standard book of reference for all gas engineers who desire to communicate in any way with members of the Society for business purposes.

Looking through the volume, we see that there is a directory of the members of the Society, with their addresses, telephone numbers, telegraphic addresses, &c. There follows a list of professional and commercial associations connected with the gas industry of the United Kingdom; and in conjunction there are given the names of the Presidents and Secretaries, together with the addresses of the latter. Succeeding, the members of the Society (in alphabetical sequence) make announcements as to the plant and appliances they each manufacture. This section of the work is beautifully illustrated; and no expense appears to have been spared by the Society in letting those who consult the volume know precisely what are the special features of the plant and goods that are produced. A very useful section is the index to the various firms, together with the classified index under products. A particularly valuable part of the volume (already incidentally mentioned) is that which deals with British standard specifications. In the first place, there are those which refer to refractory materials, retort materials, firebricks, blocks, tiles, &c., and the same under the designation of silica. There follows the specifications for motor fuel, for cast-iron pipes, and special castings for water, gas, and sewage, for portland cement, and for structural steel. We have also the standard nomenclature of tars, pitches, bitumens, and asphalts when used for road work, Specifications for tar and pitch for road purposes are also given. Supplementing all this information, which are matters of constant reference by gas engineers, there follows a description of the method of sampling and testing spent oxide, the British Standard Conditions of Contract, and a reproduction of the Gas Regulation Act of 1920. Completing this collection of usefulness are engi-

* "Society of British Gas Industries Directory, 1921." London: Society of British Gas Industries, No. 4, Bond Court, Walbrook, E.C. Price £1 1s.

neering formulæ and tables, and these are accompanied by a special index.

It is a remarkable collection of useful material for all gas engineers; and we are confident the book will in future be found near to the hand of every technical official in the industry. The volume is well printed on good paper; the illustrations (as already remarked) are excellent; and permanence is assured by the strong binding, which suggests that the members of the Society are of opinion that the work will be freely handled. It is noticed that the Society will be pleased to receive from all users of the book any suggestions they may have to make for enlarging its value. It is obvious from this that the intention is to bring out fresh editions of the volume from time to time, and to make it as complete as possible. The book is on sale at the office of the Society as mentioned in the footnote to this review.

STEAMING IN VERTICAL RETORTS.

By Dr. A. PARKER.

Comments on the Reply by Sir George Beilby and the Staff of the Fuel Research Board to the Discussion on the Paper "Steaming in Vertical Gas-Retorts." [See "Journal" for Nov. 16.]

The reply by Sir George Beilby and the staff of the Fuel Research Board to the discussion on the paper "Steaming in Vertical Gas-Retorts" presents many points of interest; but some questions of importance are overlooked or misapprehended.

WEIGHT AND CHEMICAL AND THERMAL BALANCES.

Experience at Uddingston led to the conclusion that, in tests of the type under consideration, thermal and chemical balances combined constitute a more reliable means of evaluation than weight balances alone, since the former are not affected to the same extent by the drawing-in of air. Further, elementary balances form a desirable check on methods of sampling and analysis, which is not forthcoming from weight balances.

Commander Shaw and Mr. King appear to be under a misapprehension as to the methods of construction of our chemical balances, since apparently they are under the impression that the accuracy of such balances is influenced by errors in steam measurement and in the determinations of nitrogen by difference in gas analysis. It should be clear that errors in these determinations cannot affect balances for carbon and sulphur; and in our construction of nitrogen balances, the amounts of this element, as obtained by gas analysis, were not required. In any case, according to the method of complete gas analysis adopted at Uddingston, nitrogen is measured directly, and is not a difference figure.

No attempt has been made in the reply to the discussion to explain why, in the case of Test K with Lanarkshire coal, the products coke, tar, ammonia, and cyanide, without gas, apparently contained 11 p.ct. more nitrogen than was present in the original coal; and this discrepancy would be even greater if due allowance were made for the free gaseous nitrogen produced. This is an example which clearly demonstrates the value of a nitrogen balance. Without some satisfactory explanation, it is difficult to accept the results of the determinations of nitrogen and the figure given for the yield of ammonium sulphate for Test K.

From the weight balance losses given in their reply, Commander Shaw and Mr. King conclude that, since the losses in the Uddingston tests decreased with increased steaming, the figures given for losses of steam from the mouthpiece were too high. This is not a legitimate conclusion. The explanation is to be found in the fact that in the tests with larger quantities of steam at Uddingston, a greater "pull" was maintained at the top of the retorts; and the figures support the position that weight balances are influenced according to the amounts of gas escaping from, and entering, the plant.

With regard to thermal balances, the amounts of heat absorbed in the steam-carbon reactions can be calculated with sufficient approximation to ensure greater accuracy by including these figures (as in our calculations) than by their omission, as in the calculation of the thermal losses given in the Fuel Research Board's reply. The more complete thermal balances, including the heat absorbed in the steam-carbon reactions, which appeared in my contribution to the discussion, show that the thermal losses in the Fuel Research Board's tests varied from 1·1 p.ct to 7·2 p.ct. —*i.e.*, over a range of 6·1 p.ct., as against the limits 2·4 p.ct. and 5·0 p.ct., or a range of only 2·6 p.ct. in the Uddingston tests.

Objection must be made to the statement in the Fuel Research Board's reply that the amounts of steam to the retorts and the coke in the producer at Uddingston were "estimated." These quantities were not estimated, but were determined as described in detail in the Fourth Report.

WATER BALANCES.

It is difficult to understand the Fuel Research Board's objection to the hypothesis that the amount of water formed on the distillation of coal is approximately the same in tests with the same coal, in view of the fact that, having admitted a loss of steam in Test H, the truth of the hypothesis is supported by their own series of tests with Mitchell Main coal. In any case it is highly improbable that the water formed by distillation dropped from 91 lbs. per ton in Test A, with Durham coal, to 5 lbs. in Test C, as shown by water balances; and these balances are not dependent on the truth of the hypothesis, as stated in the reply.

RESULTS WITH DURHAM COAL.

The Fuel Research Board have not indicated any explanation for their peculiar results with Durham coal. It will be remembered that in Test A, without steam, the calorific value of the gas made was 510 B.Th.U. per cubic foot, as against 518 B.Th.U. in Test B with 5 p.ct. of steam, and that less than 7 p.ct. of this 5 p.ct. of steam was decomposed, whereas in Test C nearly 27 p.ct. of the 21 p.ct. of steam admitted to the retorts was decomposed. These peculiarities surely require explanation.

HEAT LOSSES BY RADIATION, &c.

The method of calculation of losses by radiation, &c., in Uddingston Test 1, as adopted in my previous contribution, has apparently been accepted by the Fuel Research Board; but in their reply to the discussion, the figure given in the Uddingston report to represent the heat carried away by the waste gases has been replaced by figures based on assumptions with regard to the amount of moisture in producer gas. This replacement of the Uddingston figure, which resulted from actual determinations, does not possess any justification. In view of the difference in design and methods of operation of producers, it would be interesting to know the reasons for the decision by the Fuel Research Board that 30 grams of water per cubic metre represents the maximum in good producer practice. The calculations, based on determinations and not on assumptions, which were given in my previous contribution to the discussion, proved that the values 10 p.ct. and 7·5 p.ct. of the fuel to heat the setting, assumed to represent the losses by radiation, &c., in the Uddingston tests, are very near the truth. The figures given in the Uddingston report for the fuel used in the producer were corrected for the amount of breeze recovered for the boilers in such a manner that due allowance was made for differences in carbon contents of the original fuel and the breeze recovered.

EXCESS AIR FOR COMBUSTION.

It is interesting to learn that the analyses given for waste gases in the Fuel Research Board's report, with the exception of Tests J and K, do not represent the compositions of the gases entering the waste-gas flue, since the samples were vitiated by a leakage of air from the preheater. This leakage of air is a serious matter, since it may have had an important influence on the thermal balances of the retort-furnace and of the preheater. It should not, however, give rise to the discrepancies which appear in the figures obtained for the amounts of excess air as calculated from oxygen and carbon balances, provided true average samples of the mixture of waste gases and air from the preheater were obtained, and provided the analyses were correct. The leakage of air would increase to the same extent as the amounts of excess air as calculated by both methods. It would, therefore, appear that the discrepancies in the two methods of calculation result from errors in methods of sampling or analysis of fuel gas or waste gas. From the analyses given, the water gas used to heat the setting at the Fuel Research Station was undoubtedly of unusual composition.

COMPARISON OF HEAT VALUES OF WATER GAS AND PRODUCER GAS.

No attempt has been made in the reply to answer the criticism raised in the discussion under this heading, although it is essential that the soundness of the method of comparison adopted by the Fuel Research Board should be established before it can be used with confidence for the conversion of the results obtained at the Fuel Research Station into the results to be expected in ordinary practice when producer gas is used to heat the setting.

STEAM SUPPLY.

Dr. Lander seems to have missed the point in the contribution to the discussion under this heading. It was not suggested that measurement of steam by means of calibrated nozzles is better than the weighing of water supplied to a separate boiler. Steam can be measured with a fair degree of accuracy by means of calibrated nozzles provided the special precautions adopted at Uddingston are taken. With these precautions, liability to errors resulting from the inaccuracy of Bourden gauges and the variations at different steam pressures of the discharge coefficients of nozzles not of perfect steam-line design is eliminated. The point in the criticism, however, was that the information given by the Fuel Research Board with regard to the orifices used is not of service to gas engineers, since it is insufficient to enable by its use even approximate reproduction of steam-supply conditions.

Birmingham Section of the British Industries Fair.—The Birmingham Section of the British Industries Fair (Feb. 27 to March 10) will, as last year, take place in the Exhibition Buildings at Castle Bromwich. The three huge aerodromes will be crowded; for 500 firms will be represented. The power, lighting, heating, cooking, and ventilating group promises again to be one of the leading departments. It will include, of course, electrical, gas, oil, steam, and similar plant—gas-engines will be a most interesting phase of the engineering section—and there will be a host of gas and electrical appliances, accessories, and fuels. This section of the Fair will again be under the auspices of the Board of Trade and the joint organization of the Birmingham Municipality and the Chamber of Commerce.

NATIONAL GAS COUNCIL OF GREAT BRITAIN AND IRELAND.

THIRD ANNUAL GENERAL MEETING.

THE Third Annual General Meeting of the National Gas Council (as well as a Special General Meeting), took place last Wednesday afternoon, in the Æolian Hall, New Bond Street, W., under the presidency of Mr. D. MILNE WATSON.

SPECIAL GENERAL MEETING.

ALTERATION OF CONSTITUTION AND RULES.

The PRESIDENT said the first business they had to consider was the proposed alteration of the constitution and rules. There were only two real alterations; but they necessitated a certain number of other changes. The first had reference to the termination of the financial year. At the present moment, it so happened that the close of their year did not coincide with that of the other bodies with whom they were associated—namely, the Institution of Gas Engineers and the British Commercial Gas Association. The existing arrangement also necessitated the holding of their meetings in the middle of December, which he was sure they must all regard as an unmitigated nuisance. It was very inconvenient for them to leave their work at the busiest season of the year. ["Hear, hear."] In order to meet these two points, it had been suggested that their year should end on March 31 (instead of Sept. 30), and that the annual meeting should be held in the summer time, when, if ever, gas men had a little leisure. The second alteration was with reference to the auditing of the accounts. The Council had found it necessary to employ a firm of professional auditors; whereas the constitution and rules as they now stood provided for the appointment of honorary auditors only. The employment of professional auditors had rendered the office of honorary auditors unnecessary; and the resolution substituted the word "auditor" for "two honorary auditors."

The SOLICITOR (Mr. S. E. Cash) then briefly explained the proposals, which included the following consequential new rule:

RULE XX.—TRANSITORY.

Notwithstanding anything contained in the constitution and rules:

(1) The President, Honorary Treasurer, Trustees, Auditor, Honorary Secretaries, and members of the Executive Board appointed at the annual general meeting to be held on Dec. 14, 1921, shall remain in office until the annual general meeting in the year 1923; and the Chairman and Vice-Chairman to be elected in accordance with the provisions of Rule VI. (5) shall also hold office until that date.

(2) No member of the Central Executive Board elected by a District Executive Board or an associated body shall retire at the annual general meeting in the year 1922; and the retirement by rotation of such members as provided by Rule VI. (3) shall be postponed accordingly.

(3) The Chairman and Vice-Chairman and the Management Committee of each District Executive Board appointed in the year 1921 shall be entitled to remain in office until the annual meeting of their respective Boards in the year 1923.

The PRESIDENT moved that the alterations indicated be made in the rules.

Mr. J. H. ELLIS (Plymouth), in seconding, remarked that, so far as he was aware, the suggestions met with the unanimous approval of their colleagues. At any rate, everybody whom he had come across quite agreed with the changes.

The resolution was then put to the meeting and carried.

ANNUAL GENERAL MEETING.

The SECRETARY (Mr. W. J. Smith) read the minutes of the previous annual meeting; and they were confirmed. Next was read by him the list of members of the Central Executive Board appointed and nominated respectively by the District Executive Boards and associated bodies.

The Report and Accounts.

The PRESIDENT said it was now his pleasure to present the following report, together with the statement of accounts.

Gas Regulation Act.—Members have not been slow in taking advantage of the provisions of this Act, and a large number are already reaping benefit thereunder.

(*a*) *Section* 1.—*Gas* (*Charges*) *Orders.*—Orders for the revision of the standard or maximum price of gas have been granted in the case of 101 undertakings during the financial year under review.

The Council has successfully given assistance to a very large number of gas undertakings in the preparation of their applications under this section.

(*b*) *Section* 10.—*Special Orders.*—Members are now realizing the great advantages conferred by this section in affording a simpler, cheaper, and more expeditious method of obtaining special statutory powers. Special orders under this section have been granted in the case of 22 gas undertakings. Perusal of these Orders will show the extremely varied nature of the powers conferred.

(*c*) *Section* 2, *Sub-section* 2.—*Pressure of Gas.*—The Council took steps to meet the united opposition of the railway companies, who endeavoured to induce the Board of Trade to prescribe a sliding-scale whereby the pressure would be determined by the declared calorific value of the gas. These endeavours by the railway companies were frustrated by the strenuous opposition of the Council. No higher pressure than 2 in. will be prescribed, unless a lower calorific value than 350 B.Th.U. is declared; and the railway companies have failed in their claim for preferential treatment.

(*d*) *Section* 2, *Sub-section* 4.—*Carbon Monoxide and Incombustible Constituents.*—In anticipation of the holding of inquiries under the above section, the Council, in conjunction with the Institution of Gas Engineers, obtained the necessary statistics and evidence for presentation thereat. Witnesses were called on behalf of the gas industry: and so strong a case was made out that the Committee reported, in the case of carbon monoxide, that there was no necessity for any restriction, and that, in the case of incombustible constituents, no restriction was necessary at the present time.

(*e*) *Sections* 4 *and* 5.—*Testing of Gas.*—The Council has engaged, and is still engaging, in most important work in connection with several matters under these sections, such as the prescriptions of the Official Referees and the appointment of gas examiners.

Safeguarding of Industries Act, 1921 ("*Key Industries*").—Prior to the introduction of this Bill, the Council made strong representations to the Government that there was no justification for the inclusion of gas-mantles and heat-resisting glass within the scope of the Bill. The Government paid heed to these representations; and when the text of the Bill appeared, gas-mantles and heat-resisting glass were excluded. Endeavours were made in Parliament to amend the Bill for the purpose of including these articles; but these were defeated.

Electricity Supply (*No.* 2) *Bill.*—The Council, in conjunction with other bodies, was most active in organizing opposition to this Bill in the House. So strong was the opposition that this Government Bill was never read a second time.

Model Bill, 1921.—A Special Committee of the Council was appointed to formulate amendments to the 1920 Bill; and the Council is now able to report that effect has been given to a large number of their proposals in the new Bill. For example, the sub-section prohibiting gas undertakings owned by local authorities from selling gas-fittings except through a contractor has been deleted. A new clause has been inserted making it obligatory upon gas consumers using high-pressure air to provide an efficient non-return valve. The clause which confined to statutory undertakings the power to supply gas in bulk has now been altered so as to permit of the supply to, or purchase from, any person without restriction.

Draft Regulations—Factory and Workshop Act.—These regulations were in the first instance so drafted by the Home Office as to include gas-works, which thereby became subject to numerous restrictions. A deputation immediately waited upon the Home Office in January last, and obtained from them the promise that gas-works, *qua* gas-works, should not be included in the scope of the regulations. The Council then joined forces with the Association of British chemical manufacturers, and together made strong representations to the Home Office with regard generally to the subject-matter of the regulations, and in particular to the "welfare" clauses contained therein. Finally, the Home Office was induced to delete the objectionable clauses in the regulations, and, subject to a few amendments, there is no necessity for the Council to proceed with its opposition. The success achieved is largely due to the efforts of the special Committee appointed to deal with this subject.

Coal.—Immediately upon the resumption of work after the coal strike, great difficulties were encountered by gas undertakings with regard to the price demanded for gas coal. The Council, after careful consideration, recommended that gas undertakings should refrain from entering into long-term coal contracts at the prices then ruling or at pre-strike prices, and that provision should be made in every contract for a review of the price month by month. It is most satisfactory to record that the advice given was generally adopted, and that the above recommendations have been more than justified. The Council made most strenuous endeavours to obtain from the Government facilities for recouping the industry for losses incurred in purchasing foreign coal during the coal strike. A most convincing and powerful case was presented to Sir William Mitchell-Thomson, representing the President of the Board of Trade, by a deputation selected from the several districts of the Council; but, unfortunately, the Government could not be prevailed upon to introduce the necessary legislation.

Revision of Railway Rates.—The Council, in conjunction with the Federation of British Industries, has been very carefully safeguarding the interests of the gas industry in regard to the very important question of the re-classification and revision of railway rates in connection with the conveyance of coal, coke, tar, gas oil, &c., &c. Representatives of the Council have been present at the hearings of the Railway Rates Advisory Committee, and evidence has been given on behalf of the gas industry. The new classifications suggested by the railway companies and by the traders respectively have appeared in the Council's monthly report.

Workmen's Compensation Insurance.—This matter has engaged the serious attention of the Council throughout the year. Statistics have been obtained, and it is apparent that the gas industry is paying far higher premiums than the risk warrants. When the information which is being supplied by members has been tabulated, it is hoped that the Council will be able to propound a definite scheme for the whole industry. Nevertheless, even at the present stage, very considerable savings have been effected in the case of numerous undertakings.

Stove Standardization.—The Sub-Committee which has had this question under consideration has presented a very comprehensive interim report and specification for a standard cooker. Certain details of con-

struction are still the subject of experimental work; and the Council has invited the Society of British Gas Industries, should they so desire, to nominate a representative on the Sub-Committee in question. It is hoped that the final recommendations of the Sub-Committee will be placed before members in the very near future.

Sulphuric Acid and Spent Oxide.—The Council has persistently pressed the acid makers for a reduction in the price of sulphuric acid to gas-works. A slight reduction has been determined upon by the National Sulphuric Acid Association; but the Council has repeatedly pointed out that unless a further substantial reduction is made the production of sulphate of ammonia in gas-works will cease to be remunerative. At the suggestion of the Association, information is being obtained regarding the stocks and production of spent oxide throughout the country.

Legal.—There has been an immense increase of work in connection with requests for legal advice on most varied subjects. Advice has been given not only in connection with the rights and duties of gas undertakings under public and private statutes, taxation (income-tax, excess profits duty, corporation profits tax), and rating, but also in connection with a great variety of questions of both general and local application which are too numerous to set out in detail.

Monthly Reports.—Monthly reports, the issue of which has been continued throughout the year, have been greatly appreciated. These reports keep members in touch with the work carried on at head-quarters.

District Executive Boards and Management Committees.—The District Executive Boards have continued to be a great source of strength to the Council in submitting resolutions setting out the opinions of the districts. This greatly assists the work of the Central Executive Board in concentrating the views of members on important subjects. The District Secretaries have continued to give their whole-hearted services in assisting the Council's members in each of the various districts.

Income.—The total amount received by the Council by way of joint subscriptions to the National Gas Council, the British Commercial Gas Association, and the Institution of Gas Engineers (for research work) for the year 1920-21 amounted to £38 635 12s. 1d. The income of the Council for the financial year ended 30th September, 1921, including interest on deposit account, amounted to £12,612 16s. 6d.

Expenditure.—The expenditure of the Council for the past year amounted to £13,149 8s. 5d. (excluding the sum of £1500 representing additional expenses incurred to date in connection with the Publicity Fund, which was raised on behalf of the Gas Regulation Act, 1920). The net deficiency on the year's working is therefore £536 11s. 11d. The sum of £1000 shown last year as the balance of the reserve for the purchase of suitable furniture for the Council's offices at No. 30, Grosvenor Gardens, has been increased by an amount of £120 3s. 6d. which has been returned to the Council. This reserve fund now amounts to a total of £1120 3s. 6d. The sum of £1000 set aside towards the expenses connected with acquiring the premises in question is still in reserve.

General.—The valuable work which the Council is doing is reflected in the increasing number of undertakings enrolling. The following table shows the representation in the various districts of the Council:

District.	Number of Undertakings Joined.		Percentage of Total Make of Gas in each District.	
	Company.	Municipality.	Company.	Municipality.
Eastern	61	5	87·8	65·6
Ireland	28	8	82·1	90·5
London	8	—	78·8	—
Manchester	51	55	96·3	98·4
Midland	83	30	90·9	97·2
Northern	42	12	95·7	86·6
Scotland	67	40	69·5	96·0
Southern	131	7	84·2	65 0
South Wales	35	17	93·2	96·3
South-Western	76	8	94·6	92 8
Yorkshire (West Riding)	37	27	95·7	97·0
Entire Kingdom	619	209	85·4	95·9
	828		89·1	

D. MILNE WATSON, *President.*
W. J. SMITH, *Secretary.*

ADVANTAGES OF CO-OPERATION AND JOINT ACTION.

The PRESIDENT said they would remember that at last year's meeting he emphasized the necessity, and the advantages, of the gas industry's being organized as a whole, and pointed out that united action and organization were absolutely essential in dealing with the many big problems with which the industry would be faced from time to time. He thought they would agree with him, from a mere glance at the report, that the work accomplished during the year under review would justify this statement, and that the industry was now reaping considerable benefit from the adoption of a policy of co-operation and joint action. The value ascribed to the work of the Council was reflected, not only in the increase of membership, but also in its increase in status. The National Gas Council was now recognized as the representative body of the gas industry; and the views and opinions of the Council carried great weight, both inside and outside Parliament. Government Departments turned to the Council whenever they desired authoritative information on matters of importance relating to the industry; and the Council had no difficulty, as necessity arose, in obtaining a ready hearing from any particular Ministry. Looking back over the past few years, it was easy to see what immense progress in this direction had been achieved The gas industry could now speak with one voice upon all matters of common interest, and would be listened to with attention and regard.

THE GAS REGULATION ACT.

When he addressed them a year ago, the Gas Regulation Act had only recently been placed upon the Statute Book; and no Orders had been made under it. Since that time, a very large number of undertakings had applied for Orders under section 1; and if they would turn to the report, they would see that 101 Orders had been granted during the year under review. In this connection, he thought it only right to state that the gas industry had been most satisfied with the manner in which the Director of Gas Administration (Mr. H. C. Honey) had dealt with the applications. ["Hear, hear."] It was, of course, a matter of much regret and concern that all the undertakings that had applied had not yet been able to obtain their Orders under this section; but it was at least satisfactory to compare the present state of affairs with the conditions that obtained prior to the passing of the Gas Regulation Act. After all, it was no mean achievement for the Board of Trade to have made over 100 Orders between the end of March (the date of the first Order) and the end of September. There was no doubt, in his opinion, in spite of the unfortunate delay that had occurred in the case of several undertakings, that the industry had benefited by the fact that all applications were being dealt with by the same official, who might be trusted to cope in an impartial and uniform manner with the questions arising. ["Hear, hear."] He might say that he had had an interview that week with Mr. Honey, and had pointed out to him the great disappointment that was being caused to a large number of members of the National Gas Council by the fact that they were not getting their Orders through. Mr. Honey said that, of course, the difficulties were immense; and that each application required his personal attention—which they would all agree was the case. Mr. Honey went on to say that he was doing his best to push through as many Orders as he possibly could before the end of the year; and he hoped by that time he would have issued not very far short of 200 Orders.

Much work had been entailed by the consideration and preparation of the schedules under the section; and assistance in this respect had been given by the Council to a very large number of gas undertakings. One thing that he was sure all were agreed upon was that the expense of obtaining these Orders had been infinitely less than if each undertaking had gone to Parliament with a Bill of its own. Of course, it was also quite inconceivable that Parliament would have dealt with 100 Gas Bills in the space of a few months. The advantages conferred by section 10 with respect to Special Orders were now being generally realized by members; and Special Orders had been made in the case of 22 gas undertakings during the year. The procedure was simple and expeditious, and the expense but slight; while the powers conferred were so varied that it would only be necessary in exceptional cases to have recourse to private legislation.

THE RAILWAY COMPANIES AND THE INDUSTRY.

Members were well aware that the provisions of the Gas Regulation Act, particularly with regard to pressure, had never found favour with the railway companies. In spite of the defeat of their amendments when the Bill was passing through the Houses of Parliament, the railway companies had continued their efforts to obtain preferential treatment at the expense of the gas industry. The Council strenuously opposed the railway companies on every occasion; and it was satisfactory to note that their endeavours in this respect had been entirely successful. No higher pressure than 2 in. has been, or would be, prescribed unless a lower calorific value than 350 B.Th.U. was declared. He would like to lay stress upon this particular point, as it emphasized the power which a representative body such as the National Gas Council could exercise. Everyone would remember how difficult it was in the old days for undertakings to withstand individually the pressure exerted by the powerful railway companies whenever a Bill was promoted in Parliament. He said without hesitation that, unless united action could have been, and had been, taken in questions such as the one to which he had just referred, individual gas undertakings, however large, would to-day have been compelled to submit to many restrictions which could only have reacted to the detriment of the industry as a whole, and consumers at large.

THE KEY INDUSTRIES BILL.

A very large number of other questions had arisen under the Act with which he did not propose to deal in detail. The result of the inquiries with regard to carbon monoxide and incombustible constituents must, however, be specially mentioned. Owing to the efforts made by the Council and its associated bodies, the freedom for which they fought had been attained; and in this connection he thought it right to record in particular the inestimable services rendered by the Institution of Gas Engineers, to whom the gas industry owed a deep debt of gratitude. [Applause.] The Council had throughout the year carefully watched all the proceedings of the Houses of Parliament, and had taken care to secure, as far as possible (and he thought, generally speaking, with success), that no measures were passed that would jeopardize or prejudice the interests of the industry. There were two important occasions upon which the Council had to take definite action. The first case was that of the Key Indus-

tries Bill. It became known to the Council, even before the Bill was introduced, that manufacturers were exerting all possible pressure upon the Government to include expressly within the scope of the Bill gas-mantles and heat-resisting glass. The Council at once took active measures to counteract any such proposal; and even before the Financial Resolutions came before the House of Commons, they were in communication with the Board of Trade, setting-out the reasons why the articles in question should not be included in the Bill. Members were asked to communicate with their representatives in Parliament in this connection; and the necessary steps were taken to protect the interests of the gas industry during the passage of the Bill through Parliament. The most strenuous endeavours were made in the House of Commons to amend the Financial Resolutions for the purpose of including gas-mantles, as such, within the protection afforded by the Bill. These endeavours were defeated; and no amendments were made to the Bill in this connection. At the same time, the Council were not satisfied that the wording of the Financial Resolutions and Bill was sufficiently plain to prevent a claim being made that gas-mantles were covered by the words "compounds of thorium" used in the schedule. The Council immediately communicated with the Board of Trade, asking them to remove any ambiguity that might exist, and suggesting a particular form of amendment which, in their opinion, would put the question beyond all doubt. The Board of Trade, however, were so satisfied with the Bill as drafted that they did not think it necessary to take any further steps in the matter. This question was still being watched carefully; and every possible step would be taken to see that the industry was not prejudiced by the action of those who were still trying to prevent the importation of foreign mantles.

Electricity Supply (No. 2) Bill.

The Council also took action in Parliament in connection with the Electricity Supply (No. 2) Bill. The Government had stated that they intended to re-introduce the Bill; and it was read again for the first time, and placed on the Orders of the Day for second reading. This Bill contained several objectionable features; but there was one to which he would like to refer. By section 16 it was proposed to grant to railway companies practically unrestricted facilities to supply electrical current. In fact, railway companies could, under the section, supply electricity to consumers direct, without any regard to the powers with which Parliament had invested statutory gas undertakings. The Council, in conjunction with other bodies, were most active in organizing opposition to the Bill; and so strong and effective was the opposition, that the Government Bill was never read a second time. This particular danger had been averted for the moment; but one could not close one's eyes to the fact that the most vigorous efforts were being made from many quarters to induce the Government to re-introduce the Bill—or, at any rate, a Bill very similar in character. Members might rest assured that no stone would be left unturned to prevent the Government from including in any Bill that they might introduce a provision in favour of the railway companies so radically unfair as that which he had indicated.

The Model Bill.

In connection with parliamentary matters, reference should be made to the Model Bill, 1921. The Council had been aware for a considerable time that gas undertakings were dissatisfied with the clauses that had been included in prior Model Bills; and it was felt that the time had arrived when active steps should be taken to modernize the provisions, so that they might be more in accord with the present needs of the gas industry. A Special Committee of the Council was appointed to consider carefully the Model Bill then in existence, and to formulate amendments for the Lord Chairman's consideration. With the assistance of Messrs. Dyson, Bell, and Co. (the Council's Parliamentary Agents), the Council were successful with regard to a large number of their proposals which had been included in the new Bill. He thought it unnecessary to enter into a detailed story of the amendments made, or the reasons for such amendments. Local authorities would be gratified to see that they were no longer precluded from selling gas-fittings except through a contractor. To mention two other matters, a new clause had been inserted making it obligatory upon gas consumers using high-pressure air to provide an efficient non-return valve; and the clause which confined to statutory undertakings the power to supply gas in bulk had now been amended so as to permit of the supply to, or purchase from, any person without restriction. The Council were fully alive to the fact that the present Model Bill, even as amended, was not by any means entirely satisfactory; and endeavours would again be made next year to induce the Lord Chairman further to modify or enlarge the clauses.

The Vital Question of Coal.

No annual report of the National Gas Council would, he supposed, be complete unless some reference was made to the vital question of coal. This, of course, had been one of the most difficult years—if not the most difficult—in the history of the gas industry. The disastrous effects of the coal strike, and the consequential losses involved, were, of course, still present in everyone's mind. It was deplorable to think that the gas industry was unable to obtain any compensation or relief for its patriotic co-operation with the Government and loyal service to the consumer during this prolonged crisis. He thought every member who was present at the deputation to Sir William Mitchell-Thomson must have come away from the Board of Trade offices feeling that an unassailable case had been made out for some assistance to the already depleted exchequers of gas undertakings; and there was very good reason for believing that he (Sir William Mitchell-Thomson) himself felt the case had been entirely made out. But, of course, their appeal fell at a bad time, when there was no money in the national exchequer; and therefore, with thanks for their services, they were turned away empty. The total loss incurred by the industry through the coal strike was the enormous figure of £4,000,000; and the only silver lining to this black cloud was that the public probably realized for the first time the enormous advantage of having a gas supply; and it was doubtful whether the gas industry, as a Public Utility Service, ever stood higher in public opinion than it did to-day in consequence. The industry as a whole kept faith with the public, and enabled the community to survive with as little discomfort as possible during those trying days. In this respect, the Council afforded undoubted assistance to a very large number of undertakings in obtaining for them supplies of coal and coke which otherwise could not have been obtained.

He could not pass from this particular subject without reference to the extraordinarily effective co-operative schemes which were put into operation in certain districts. The fact that an organization existed permitting immediate action proved of inestimable value. It became possible to make co-operative purchases of foreign coal at a cost far less than that paid by those undertakings which were not so happily situated as to be able to avail themselves of the benefits of co-operation. Immediately work was resumed after the strike, great difficulties were encountered by gas undertakings with regard to the prices demanded for coal. This all-important question was considered at many meetings of the Central Executive Board, who, after careful consideration, recommended that gas undertakings should refrain from entering into long-term coal contracts at the prices then ruling, or at pre-strike prices. Generally speaking, these recommendations were followed by undertakings; and the industry had thus been enabled to purchase coal at a much lower price than it otherwise would have been able to do.

Stove Standardization.

It would take a very long time to enumerate in detail the work of the Council with regard to some of the other items appearing in the report—such as the draft regulations under the Factory and Workshop Act, the revision of railway rates, and workmen's compensation insurance. All these questions—involving as they did large sums of money—merited more attention than could be devoted to them that day; but members had doubtless made themselves aware of the difficulties encountered and the steps which had been taken in connection with these particular matters. A word, however, should be said with regard to the question of stove standardization. No doubt a large number of members thought that undue delay had attended this subject; but he could assure them that most valuable and excellent work had been accomplished in regard to the question by the Sub-Committee which had been appointed to investigate it. A full and comprehensive interim report and specification of a standard cooker had been prepared; and stove manufacturers had now accepted an invitation to nominate representatives on the Sub-Committee. He thought members would not have to wait long before the final recommendations were laid before them.

Sulphuric Acid and Spent Oxide.

The question of sulphuric acid and spent oxide was still unsatisfactory, notwithstanding the reductions which had been obtained from the National Sulphuric Acid Association. Upon the suggestion of this Association, information was now being obtained regarding the stocks and production of spent oxide throughout the country; and it was hoped that the Council would be successful in obtaining further reductions in the course of the next few months. If no such reduction was forthcoming, the Council would have seriously to consider what steps to take to protect themselves.

Answering Inquiries.

One of the features of the year had been the immense increase of work in connection with requests for advice on all manner of questions from individual undertakings. He believed that the average number of letters sent out of the office every day amounted to 150, which represented some 50,000 communications in the course of the year. This was a very fine record of work. [Applause.] With regard to the use that members were making of the National Gas Council, he particularly noticed that they were asking for legal advice; and the subjects dealt with had been most varied in character and wide in application. This branch of the Council's activities was, of course, peculiarly useful to the smaller undertakings, and would doubtless grow more and more as the years progressed.

A Good Record.

Such was a very brief sketch of the year's work of the Council; and he thought every member present ought to feel that there was cause for congratulation. But they must not be content with resting on their oars. They must think of the future. What was in store for the gas industry? He thought the most salient feature of the times was the reckless propaganda which

was being disseminated broadcast in favour of electricity. No one wished to belittle the work which was being done by electricity supply undertakings; but care and great watchfulness were necessary that no measure was introduced, nor any steps taken, that might prejudice the interests of the gas industry. Personally, he viewed this propaganda without fear or trepidation, if reasonable steps were taken to counter it. It must be remembered that the gas industry was firmly established in every city, town, and village, and had not, therefore, the scope for booming grandiose schemes in the hope of capturing the popular imagination, as had electricity. Though there might not be so much room for such schemes, there was a tremendous field before the gas industry which could be occupied if the industry determined to take advantage of the freedom which it had recently obtained. Great things had been achieved by their unity. Still greater things would be achieved if this unity was maintained—recognizing, as they ought to do, the necessity of mutual defence and the community of their aims. [Loud applause.] He concluded by moving—"That the annual report and audited statement of accounts for the financial year ended Sept. 30, 1921, as circulated, be approved and adopted."

UNITY ESSENTIAL.

Alderman WILLIAM KAY (Manchester) said that, after the very explicit and excellent report which the President had presented, there was little he need say in seconding the resolution. He did, however, want, if possible, to stress a little bit the fact that, although they had the Gas Regulation Act, this was not the "be all and end all" of their existence. They must still further consolidate the ground in opposition to the many insidious and awkward attacks made upon them. They were confronted by a series of problems that could only be met by a united body and a united industry. They had obtained a great deal; but they wanted all. And having got it all, they would successfully hold the position they were entitled to, as one of the most important industries in the kingdom. The future lay before them. The war had brought out of the industry more than most of them ever thought was in it. The fruit was there to be gathered, if they would only work together. He did hope they would all stand together, and that everybody would join the National Gas Council.

Mr. ARTHUR F. PHILLIPS, in a few words, supported the motion. He said he was sure those who had followed the work of the Council during the past year would appreciate the great benefit that it had been to the gas industry generally. Therefore they could not do better than heartily support the resolution.

THE CASE OF COMPANIES STILL WAITING FOR ORDERS.

Mr. A. W. OKE remarked that, while heartily supporting the report, he could not help calling attention to the fact that, up to this date, only 101 companies had obtained relief under section 1 of the Gas Regulation Act. This was not simply a loss to the companies that had not yet got their Orders, and would not obtain them this year; but, if he was right, the companies as they came in late, or as their cases were dealt with late, would not secure the same terms as those undertakings which had been more fortunate had done. His suggestion was that something should be done to enable these later companies to have the figures considered on the basis (say) of last year; so that, while there might be delay, and perhaps not unreasonable delay, with the Board of Trade, they might not lose anything through the economy of the Government in having only one gentleman to look after this matter. He was interested as a director or shareholder in various gas companies; and, speaking personally, he should complain bitterly if he did not feel that the Council would do their utmost to see that justice was done to the companies, and that they did not lose through economy at the Board of Trade. ["Hear, hear."]

The PRESIDENT said this point was well before them. Meetings had already taken place on the subject; and every effort would be made to see whether some arrangement could not be come to whereby companies who had not so far got their Orders granted would not be prejudiced. It was, however, not in the Council's hands. More could not be said than that everything possible was being done to press the point upon the Government Department concerned.

FOREIGN COAL AND COMPENSATION.

Mr. H. A. THOMAS (Cheltenham) asked whether the Council had absolutely given up all attempts to get any compensation in the matter of foreign coal. He knew that a well-presented claim was made; but it seemed to him it ought not to be completely abandoned without further effort. His own Company suffered heavily through purchasing foreign coal in order to keep up the supply of gas; and he would like to suggest to the Council that at least one more effort should be made to influence the Government in this respect. As to the granting of Orders under the Gas Regulation Act, his Company did not find any difficulty in getting an Order within a reasonable time; and he must say that he appreciated the suggestion of the President that there was an advantage in the same gentleman and the same staff of officials always dealing with the matter.

The resolution was then put to the meeting, and was carried unanimously.

THE PRESIDENT.

Alderman F. S. PHILLIPS (Salford), proposing the election of President for the forthcoming year, said this matter had been raised at a meeting on the previous day of the Central Executive Board of the Council; and they were very much embarrassed by the strong desire which was expressed by Mr. Milne Watson that he should be allowed to retire from the office which they would all agree he had so well and so usefully filled as President. [Applause.] The meeting absolutely disagreed with him; and a resolution was carried unanimously that he should allow himself to be nominated. It was now his (the speaker's) privilege to make this proposal to them. He could take up a good deal of their time—but he would not do so—by pointing out how enormously their organization had benefited from the fact that Mr. Milne Watson had been President; how potent his influence had been; how unwearied his attention had been; how well upon every possible occasion he had represented the National Gas Council; and how he had succeeded time after time to their very great advantage. Though Mr. Milne Watson had urged that they were now through the stress of their difficulties, and were getting into smooth water, they were not there yet. There were more difficulties ahead; and they must re-elect him their President. Very sincerely, with a full heart, feeling that they were indebted to him in a way they could not repay, it was his great privilege to move that Mr. Milne Watson be re-elected President for the ensuing year; and he felt quite sure this would meet with not only a unanimous, but an enthusiastic, response.

Mr. WILLIAM CASH, in seconding, said he would like to associate himself with everything that had just been said. The President was perfectly right when he stated that the past year had been one of hard work; but at the same time it had been a year of successful work, and in a very large measure the success had been due to the guidance they had received from their President. He would like to add that, in directing the affairs of the National Gas Council, he thought the President had never once forgotten that it was a National Gas Council, and had always had before him not only the immediate interests and requirements of any particular undertaking—whether it happened to be a small undertaking or otherwise—but the welfare of the whole industry. He had been a model of impartiality; and they could not possibly do better than elect him President for another year. [Applause.]

The proposition was heartily carried.

The PRESIDENT said he did not know how to thank them; but he regarded his re-election as a very high compliment. He did think the time had arrived, now they were in smoother water, when the honour should be passed round. But he felt, notwithstanding the fact that he was sincerely anxious to retire, that, in face of the unanimous request of the Central Executive Board, which the meeting had just endorsed, he could not insist upon his own personal convenience in the matter.

OTHER APPOINTMENTS.

On the proposition of Sir DANIEL F. GODDARD, seconded by Mr. CHARLES WOOD, Alderman William Kay was re-elected Hon. Treasurer.

The PRESIDENT moved the appointment as Professional Auditor of Mr. Alfred Morland, of Messrs. Wood, Drew, and Co.

Mr. GEORGE CLARRY (Cardiff), seconding, said he knew from experience that the accounts were of considerable extent; but they were very well kept. The staff did their work excellently; and he fully agreed with the proposition to have only professional auditors in the future.

A hearty vote of thanks was passed, on the motion of the PRESIDENT, seconded by Mr. INGRAM, to Messrs. E. L. Burton and George Clarry, the retiring Auditors. He remarked that they had given a great deal of time to this voluntary work, at much inconvenience to themselves—Mr. Clarry coming to London all the way from Cardiff for the audit.

On the motion of Mr. F. P. TARRATT (Newcastle-upon-Tyne), seconded by Mr. OCTAVIUS THOMAS (Pentre), Messrs. F. W. Goodenough and W. E. Price were re-elected Hon. Secretaries, and Sir Halliwell Rogers and Mr. H. Wade Deacon, C.B.E., Trustees.

THE BOARD OF TRADE TO BE AGAIN APPROACHED.

The PRESIDENT remarked that, arising out of what had been said, while recognizing the great services that had been rendered by Mr. Honey, the financial effect on the industry of not getting the Orders through was, of course, very serious; and he suggested that a resolution should be passed to the effect that representations be made to the Board of Trade, pointing out the detriment to the industry of delay, and urging that the matter should be expedited by every possible means.

A resolution to the above effect was moved by Mr. H. E. BLOOR (York), seconded by Mr. J. E. NORMAN (Weston-super-Mare), and passed unanimously.

The PRESIDENT proposed a hearty vote of thanks to the staff—declaring that it would be impossible to find a better one than they had. Such a staff, in an organization of this character, was of enormous value.

Mr. ELLIS seconded the motion, which was carried and briefly acknowledged by Mr. E. J. FOTTRELL and Mr. S. S. OGILVIE.

The PRESIDENT said they owed a great debt of gratitude to the District Committees, and especially to the Secretaries. Without these local organizations, the central body would work in vain. He proposed a hearty vote of thanks to them.

This was seconded by Mr. WILLIAM CASH, and passed with acclamation.

ELECTRICITY SUPPLY MEMORANDA.

THE Electricity Commissioners have issued their report on the schemes submitted to them last summer for the reorganization of the electricity supply of London. The provisionally defined district is confirmed, with certain small modifications. A Joint Electricity Authority is to be established without delay, to carry out the necessary reorganization; and this is to consist of 26 representatives (or 27 if the Chairman is elected from outside). The constitution is: Local authorities, eight members; companies, eight; London County Council, six; other county councils, three; railway companies, one. The Commissioners generally concur in the engineering proposals submitted for dealing with the requirements of the area during the first stage. These involve the extension of some of the existing plants and the grouping of stations, so that the fullest use may be made of the plant, which will amount by 1925-26 to 633,000 KW. The Commissioners have taken the course of least resistance financially; and in this they are wise. For developments beyond the first stage, they have evolved a modified scheme, which will show a substantial saving over the schemes submitted. The modified scheme involves the erection of a well-placed river-side station or stations; and the first capital one is to be that on the Barking site which the County of London Electric Supply Company have acquired, and on which they are prepared to begin immediately the construction of a 100,000 KW. station. But before August, 1926, the Company can be called upon to sell the station to the Joint Authority on prescribed terms. The alternative schemes that were submitted for meeting the anticipated developments in the period beginning in 1925-26, involved capital expenditure in the one case of £9,750,000, and in the other of £23,855,000. The scheme the Commissioners have adopted will need practically no more new capital expenditure than would do the continued extension of the group stations. Further, as compared with the estimated annual cost of electricity supplied to authorized distributors—viz., £7,262,700, or 1·147d. per unit, under one of the schemes submitted—the Commissioners' proposals, it is stated, "should" enable (not "will" enable) electricity to be delivered at a cost of £6,190,700, or 0·978d. per unit. This would mean an annual saving of upwards of £1,000,000, or 15 p.ct., with all the advantages derivable from a capital station—such as availability for large railway or other supplies in bulk at favourable rates. The expected economies, the Commissioners point out, cannot be effected unless there is inter-communication of the principal generating stations in the area, combined with the pooling of the available plant. It is clear that eventually there will be an extensive slaughter of some of the poorer existing stations. Excluding stations owned by power companies, only some twelve to fourteen will ultimately survive for generating purposes; and these should vest in the Joint Authority. The remainder (of which about fifty will be gradually closed-down) are to be incorporated in the scheme under an appropriate system of control. It is understood that negotiations as to the terms of transfer of the generating stations to the Joint Authority are in progress. There appear to be exceptions made in the case of the North Metropolitan Electric Power Supply Company and the Metropolitan Electric Supply Company who are to have delegated to them the supply powers of the Joint Authority in their respective areas. The Commissioners evidently do not agree with the view that a Joint Authority will not be able to generate more cheaply than railway companies; and they consider that a combined supply from a common source will be advantageous to both parties. The decisions will be embodied in a Draft Order, which will have to be the subject of a further inquiry, as provided by the Act of 1919. The Beckton scheme has apparently been shelved for the present.

Supply Reorganization for London.

Water Power and Electricity Generation.

The folly of the Government in treating the question of the power requirements of the country as being summed-up by electrical power has been evidenced over and over again since the various Committees reported on the subject. There is further evidence of this in the final report of the Committee appointed to inquire into the question of the water-power resources of the United Kingdom. The Committee are altogether opposed to those who think that these resources are negligible. Surveys undertaken by them establish a *primâ facie* presumption that some 210,000 KW. in the form of electrical energy could be developed continuously day and night throughout the year "at an economic rate" from those British schemes which were considered by them. The Irish Sub-Committee are of opinion that from a portion only of the water-power resources of Ireland a continuous output of 113,000 KW. could be obtained. In the case of Great Britain, the Committee point-out that the potential electrical output of the commercially practicable schemes before them is equal to about 40 p.ct. of the total output in the year 1917-18 of the 410 British public electricity supply and electric tramway and railway undertakings operated by steam power, and that the development of this amount of energy in steam stations would involve the consumption of nearly 3 million tons of coal per annum. The distribution of the water power does not seem good. The bulk of the larger water powers are situated in the Scottish Highlands; and the water powers of Wales are situated in the north-western part of the Principality. In England the main sources of water power are the small falls on rivers. The power available at any particular site would be small; but the Committee consider that the aggregate output that might be obtained by improving these sites, by installing modern turbines in the place of inefficient plant at existing sites, and the general improvement of the watercourses, is considerable. There will be many competent electrical engineers who will doubt this; but nevertheless the report of the Committee, together with the report made by Sir Dugald Clerk and Professors Smithells and Cobb, on gas and electricity in relation to coal conservation, are sufficient to prove that the Government ought to have considered our power resources as a whole, and not concentrated on one part only of the matter. As it is in connection with the electrical reorganizing work, the Electricity Commissioners are not in any way considering the question of potential water power for generating energy. The Water Powers Committee suggest that a Water Commission should be appointed to have surveillance over the development of water power.

A Mare's Nest.

The "Daily Express" has come to the conclusion that the electricity consumers of London are being squeezed, that unfair charges are being made that hamper industry, and that the profits of the fourteen electricity supply companies are being unduly swollen. This is all very interesting; but the figures the paper cites do not appear to bear-out the assertion. It is stated that the gross profits last year were £477,000 more than in 1912; the average being in 1912 6·41 p.ct., and last year 9·09 p.ct. The gross profits have little to do with the matter. Probably a large amount of fairly expensive debenture stock has been issued, as well as fairly considerable borrowings from the bankers with which to carry-on. Anyway, the gross profits only average-out to £34,000 more per company. There is not much in the point. The next one made is that the average price of electricity was raised from 2·63d. to 3·7d. during the war; and it still remains at top war figures. The consumers of London ought to be highly gratified that the average has increased so little. The difference between the two figures is only 1·07d.; or upon the 2·63d., about 40 p.ct. increase. It is said the charges are unfair and hamper industry. Industry does not pay the average charge. The price to industry is very low; and the average is brought down to the figure of 3·7d. by combining the charges for lighting, heating, and power, and dividing by the total number of units sold for all purposes. The average figure is therefore eloquent of a low price for power. The "Express" obviously does not know much about what constitutes the cost of electricity. It thinks because there has been a fall in the price of coal and other commodities during the past year, this should mean a saving in cost of hundreds of thousands of pounds on the aggregate of the coal bills. Capital charges are the main costs in the production and distribution of current, and not fuel, although this year the fuel cost of keeping the supply going during the strike has been immense, and this extra cost has to be liquidated somehow. Labour, too, costs more; so do railway rates, rates and taxes, and in fact everything. Capital costs being so much greater, and therefore maintenance and renewals, more must go to depreciation. We have no brief to defend the electricity companies' charges. But there must be fairness. The electricity charges in London compare well with those in other parts of the country, although London has to bring its fuel and plant supplies such a distance. The "Express," in our opinion, has found a mare's nest.

Small Uses and Heat Control.

Some people in the electricity supply industry, as we have recently intimated, are very anxious to develop domestic electricity business on the principle of getting-in the thin end of the wedge, by inducing consumers to utilize small appliances. Progress in heating matters by the electrical method seems to lag. Mr. H. J. Dowsing, in a letter to "Electrical Industries," states that it was thirty years ago—in 1891—that he first lectured at the Crystal Palace on electric heating. Thirty years! And electric heating is still playing on the fringe of practical work and efficiency; and now prices are against it in every direction—prices of appliances, installation, and energy. Mr. Dowsing gives quite a good catalogue of purposes to which he has applied electrically generated heat; but most of these things have not attained such a popularity that much has been heard of them. He thinks it is all a question of cost that prevents electricity making big headway; and there is very good evidence that he is right. He suggests, too, that if there were standard voltages throughout the country, the manufacturers could produce appliances at a considerably different price. At the present time, the makers have to stock for nearly twenty different varieties of voltages. Commenting upon this letter and other matters, our contemporary refers to the perfect control of electric heating, particularly for cooking purposes, and says it is this element of control that gives electric cooking its "superiority." Postulation does its best to keep fiction alive. It is also found in another statement of our contemporary. Changes of temperature, it says, can with electrical operation be effected with speed, and to suit all kinds of cooking operations. It is curious how conditions are made to suit the electrical argument. Sometimes electric-ovens are said to be so constructed that they lose little heat; and, in fact, cooking can continue after the energy is switched-off. How then can the

temperature be "speedily" changed if (say) the current is "full-on," and is then reduced to "half-on"? Where does the heat go to that allows this speedy reduction when, according to another argument, there is such a notable lag in heat loss?

Free or Assisted Wiring.

The correspondence continues in the "Electrical Times" as to who should pay the house wiring bill; and the weight of argument is against the proposal. Our contemporary thinks that too much is made of the difficulties of free-wiring schemes, and not enough of the improved position, both legal and competitive, in which electric supply authorities stand to-day. It does not include "financially" as a feature of the "improved position." It adds that an obstacle exists which keeps tens of thousands of consumers off the mains—viz., the initial wiring bill—and it declines to believe this obstacle is insuperable in every case. Among the correspondence is a vigorous letter from Mr. W. F. Stamp, of St. Austell. He describes the idea as "ridiculous." This opinion is based on the fact that, owing to the Shop Hours Act, it is now necessary to have twice the number of consumers it was requisite to have before the war to get the same output. This means twice the capital outlay to do the same business. The peak load is therefore increased roughly 50 p.ct.; and the hours over which current can be sold are decreased roughly by 50 p.ct. Added to this is daylight saving, which has very adversely affected electricity undertakings. To wire to consumers' ceiling-roses would involve an enormous outlay. There is also always the danger of tenants leaving, and new ones not requiring the light. So nothing will make Mr. Stamp go beyond the consumer's fuses and meter. He is obviously a strong opponent of speculation.

COMMITTEE ON SMOKE ABATEMENT.

Final Report.

THERE has now been issued the final report [an interim report appeared about the middle of last year] to the Ministry of Health of the Departmental Committee on Smoke and Noxious Vapours Abatement, who were appointed, under the chairmanship of Lord Newton, "to consider the present state of the law with regard to the pollution of the air by smoke and other noxious vapours, and its administration, and to advise what steps are desirable and practicable with a view to diminishing the evils still arising from such pollution." The price of the present report is 6d. net; and it includes a copy of the interim report, which was on the subject of domestic smoke, with particular reference to the Government housing schemes.

The present report opens with a historical sketch, which is followed by consideration of the present law with regard to smoke nuisances. There is an appendix which sets forth the results of an inquiry by Lord Newton and Mr. E. D. Simon, who visited the principal industrial towns of the Rhine Province and Westphalia, as well as other German cities, and found that the amount of atmospheric pollution, in comparable districts, is very much less in Germany than in this country—a fact which is attributed mainly to the almost complete absence of domestic smoke. Their report shows clearly that the comparative cleanness of the atmosphere in German towns is due not so much to the action of the Government as to the intelligent co-operation of all parties in the interest both of the most economical and effective use of fuel, and of the general amenity of life. It appears that there is in that country a wider use of gas in factories than is the case here. However, it is in fairness pointed out that "the great development of industry in Germany is of comparatively recent growth, and that consequently the German nation enjoyed the great advantage of being able to profit by the experience and the mistakes of other countries."

Returning to the report of the Committee, facts and figures are again quoted to indicate that the Committee have received abundant evidence to show that the nuisance caused by smoke and noxious vapours is very real and widespread. They think that by this time it should be regarded as an axiom that an impure atmosphere is highly deleterious to health and property, that it is indicative of wasted fuel and energy, and that every practicable step should be taken to prevent it.

The responsibility of dwelling-house chimneys for a large percentage of smoke in the atmosphere of towns is recognized; but, after full consideration, the Committee do not consider it practicable at present to propose legislation dealing with smoke from private dwelling-houses. They think, however, that the time has come when some measure of control over the heating arrangements of new buildings other than private dwelling-houses—such as hotels, clubs, blocks of offices, and the like—may usefully be exercised by local authorities. These buildings, while contributing in no small measure to the pollution of the atmosphere of towns, admittedly cannot be adequately and economically heated by means of raw coal burned in open grates. Central heating, or central heating combined with some supplementary form of heating, such as gas or electric fires, is probably the most suitable and economical method of effectively heating such buildings. It is therefore recommended that local authorities should be empowered to make bye-laws requiring the provision of smokeless heating arrangements in new buildings other than private dwelling-houses. The hope is expressed that the price at present charged for electricity in many localities will be reduced to such a point as to allow of a considerable extension of its use.

As to gas, the Committee say: "The evidence shows that gas for cooking and heating has many advantages over the coal-fire; and we are glad to note that its use is extending rapidly. We consider that municipalities should do everything practicable to extend its use; and we note with regret that the Ministry of Health have not required gas heating and other smokeless arrangements in the new houses erected under the housing schemes. We desire in this connection to draw attention to our recommendation in the interim report that 'the Central Housing Authority should decline to sanction any housing scheme . . . unless specific provision is made in the plans for the adoption of smokeless methods. . . . The only exception to this rule should be when the Central Authority are fully satisfied that the adoption of such methods is impracticable.'"

The Committee had their attention drawn in evidence to the Barnsley smokeless fuel plant, and subsequently had the advantage of a memorandum by the Director of Fuel Research on an inspection he has recently made of this plant at work. The general conclusions which the Committee draw from this memorandum are that, "while definite progress has been made in the development of this plant, the period of its regular operation has not been sufficiently prolonged to test it thoroughly from the engineering and technical points of view, and that on the economic side much remains to be done in the finding of paying outlets for the oils and gases, as well as for the coke. Till the engineering, technical, and economic aspects have been further tested and developed, it will not be possible to determine to what extent this particular method will contribute to the solution of the wider national problem in which the Committee are interested—viz., the replacement by the products of its carbonization at low temperatures of tens of millions of tons of coal which are at present consumed in the raw state."

The Committee attach great importance to the continuance of the experimental research work at present being carried on by the Fuel Research Board and others, which they trust may be pressed to an early and successful conclusion. It is, they say, clear that the smoke problem—particularly with regard to smoke from domestic sources—will finally be solved when, and if, a solid smokeless fuel can be produced economically on a commercial scale. "It might then be both practicable and desirable to legislate against the burning of raw coal."

There are recommendations for the better control of smoke emission from industrial processes. As to domestic smoke, in addition to the opinion already quoted, the Committee urged, in their interim report, that the Government should "encourage the co-ordination and extension of research into domestic heating generally. This is a matter of great importance in view of the many outstanding problems which demand inquiry." Again, they recommended that "gas and electricity undertakers should be given every facility and encouragement to increase and cheapen the supply of gas and electricity, and that the practice at present followed by some municipal authorities of over-charging for gas and electricity in order to allocate the profits thus accruing to the relief of the rates should be discontinued." The obvious conclusion to be drawn from their inquiry is, the Committee add, that the prevalence of smoke pollution in this country is mainly due to the indiscriminate and wasteful use of raw coal for all purposes, and to the lax administration of the law by the responsible authorities. It is also clear that there is no bold or simple remedy which might appeal to the imagination and excite the enthusiasm of the general public.

NATIONAL GAS COUNCIL.

Meeting of the Central Executive Board.

A MEETING of the Central Executive Board was held on the 13th inst. at No. 30, Grosvenor Gardens, S.W.—Mr. D. MILNE WATSON in the chair.

ALTERATIONS TO CONSTITUTION AND RULES.

Proposed alterations to the constitution and rules were submitted, to provide for the ending of the Council's financial year in future on the 31st of March, instead of the 30th of September, and for the holding of the annual general meeting in June, instead of December, in future. These amendments met with the approval of the Central Executive Board.

ADVISORY COMMITTEE ON COAL—APPOINTMENT TO THE COMMITTEE OF THE PRESIDENT OF THE COUNCIL.

The announcement that Mr. D. Milne Watson had been appointed a member of the Advisory Committee on Coal under the Mining Industry Act, 1920, was received with much satisfaction.

NOMINATION OF CANDIDATE FOR THE OFFICE OF PRESIDENT.

The Chairman (Mr. D. Milne Watson), on being nominated for the office of President of the Council for the ensuing year, explained to the Board that, having completed three years in office, he had decided not to allow himself to be re-nominated.

The Central Executive Board thereupon earnestly appealed to him to reconsider the matter; and ultimately, in deference to their

unanimous wishes, he agreed to allow himself to be nominated on this occasion.

RAILWAYS ACT, 1921—GENERAL PANEL.

It was reported that a communication had been received from the Board of Trade, stating that it was proposed to appoint two members to represent the Chemical and Fertilizers, Oils, and Dangerous Goods Industries, and inviting the Council to submit names for consideration by the President of the Board of Trade. It was decided to confer with the Association of British Chemical Manufacturers with regard to this matter.

CORPORATION PROFITS TAX.

It was reported that the period of exemption expired on the 31st December, 1922, and that it would be necessary for special provisions to be made again in the Finance Act of this year if the concessions were to be continued. The Council determined to take all possible steps to retain the present concessions.

SUPPLY OF ELECTRICITY BY A RAILWAY COMPANY IN THE AREA OF A STATUTORY GAS UNDERTAKING.

This question, which has already been discussed at previous meetings of the Central Executive Board, was again referred to; and counsel's opinion had been taken on the matter. It was agreed that the Council should take this matter up with the railway company concerned, with a view to restraining their activities in this direction.

APPOINTMENT OF GAS EXAMINERS UNDER THE GAS REGULATION ACT.

It was reported that recommendations from the various District Executive Boards with regard to this matter were not yet all to hand. Counsel's opinion was quoted as to the interpretation of the words appearing in the Act, requiring that any gas examiner appointed thereunder should be a "competent and impartial person." This opinion will be circulated among members in due course. Discussion of the matter was adjourned until the next meeting, when it was hoped to be in possession of the views of each district.

GAS-MANTLES.

A meeting of the Emergency Committee of the Central Executive Board was reported to have taken place on Nov. 29, to consider whether the Council should oppose the application of the Incandescent Mantle Manufacturers' Association before the Referee appointed by the Board of Trade—viz., that gas-mantles should be included in the list of goods chargeable to duty under the schedule of the Safeguarding of Industries Act, 1921. The Emergency Committee, it was reported, had unanimously decided that the Council should oppose this application, which has accordingly been done; and the Referee announced his decision on Saturday, the 10th inst. The text of the award had not yet been received. The Council were instructed to continue their opposition to the inclusion of mantles in the protection of the Act.

WORKMEN'S COMPENSATION INSURANCE.

It was reported that several quotations had been received from insurance companies and mutual associations, and from Lloyds, regarding this matter. These had been considered by the Committee appointed to deal with the subject, who had recommended that the proposals put forward by Lloyds appeared the most advantageous. The Central Executive Board recommended the adoption of these proposals, which would in a number of cases result in a very large annual saving to gas undertakings.

GAS-METER TESTING.

It was reported that three important concessions had been obtained by the Council from the Standards Department of the Board of Trade in relation to the testing of meters and the certificates given in respect of meters. The memorandum which the Board of Trade are issuing to Gas-Meter Inspectors with regard to these three matters will be published by the Council in convenient form in addition to appearing in the monthly report.

Chain-Screens for Furnaces and Ovens.

Chain-screens, which have been used in connection with a number of furnaces heated by gas, as well as with coke-oven plants, are found by the United States makers—a Baltimore firm—to be vastly superior to older methods of protecting the furnace attendants, because the chain-screen also protects the furnace and its charge from loss of heat and chill. Chain furnace screens consist of a multitude of separate strands of chain hanging from a suitable supporting bar, forming a curtain of chain. This curtain of chain, hung before an oven or furnace opening, effectively hinders the cold air on the outside from entering the furnace and chilling the contents, and prevents the heat, glare, and gases from escaping from the furnace, to the loss of the manufacturer and the discomfort of the workmen. The loosely-hanging strands of chain are parted and pressed aside by the tools or charge when projected into the furnace, only to fall together again and close the opening when entrance has been effected. The openings in the chain permit a clear view of the interior; and the attendants can, without discomfort, work up to within a few inches of the fire. The chain-doors are usually fastened to the bottom of the ordinary vertically sliding door, which the chain-door replaces, when the former is raised. On continuous furnaces, the chain-door is generally permanently attached to the furnace front, and hangs down over the opening.

THE COMMERCIAL SIDE.

By "LUMEN."

THE editorial article in the "JOURNAL" of the 7th inst. (p. 675), entitled "Acumen in the Gas Business," is so much to the point that it ought to be read and marked not only by gas officers, but also by gas directors and gas committee men throughout the country. The trouble, however, is that our excellent Gas Press is not read by members of gas directorates and Committees who most need improvement. It is those who take their positions seriously, and who are anxious to keep abreast of progressive ideas, who scan its pages; and they, unfortunately, form but a small percentage of the whole.

During the past decade or two, the qualifications of gas directors for the positions they occupy has, on the average, risen; but there are still a large number of "old fossils and candlestick makers"—to quote Dr. Carpenter—"who have no business on boards of directors." It is men like these that take the heart out of an enterprising officer, and act as a blight on the prosperity of the concerns they are supposed to direct. Bad as it is in the case of some gas companies, it is much worse in that of corporation gas committees. The men forming these committees—who are constantly changing—are excellent fellows in their way; but the majority of them have not the remotest idea of how to run a large business on progressive and far-seeing lines, nor are they capable of estimating the monetary value of a good servant. They also have a deeply rooted dislike to the creation of a new office, for this means more salaries; and the mere mention of the word has the same effect upon the ordinary town councillor as a red flag is said to have upon a bull—it creates excitement and anger of so fierce a kind as can scarcely be imagined by those who have not witnessed it.

When you have men of the calibre of Dr. Chas. Carpenter, Mr. T. Goulden, Mr. F. W. Goodenough, and Mr. W. J. Sandeman advocating the separation of the technical side and the commercial side of large gas undertakings, there is no need to waste time in arguing in favour of the idea—it can be accepted as perfectly sound. Unfortunately, however, it is in everybody's experience that good ideas, backed-up by sound arguments, do not always win-through—the "human element" often stands as a barrier to progress. An acute American writer has said he doesn't care how good old methods are—new ones are better, even if they're only just as good; but this is a philosophy that does not appeal to the typical Britisher, who is still, in spite of the trumpet call of the new times for new methods, a blind worshipper of tradition and precedent.

Let me give a personal experience by way of illustration. I was at one time associated with a large corporation gas undertaking where the engineer and manager was overwhelmed with ever-increasing duties. He was conscientious and hard-working, and liked to see to everything himself. The greater part of his time—three-fourths at least—was spent at his town office, the remainder at the works and in the district. His chief assistants were also at the town office; so that the works, where more than 400 men were employed, were left virtually to the supervision of a general foreman. When the engineer and manager came to retire, I made bold to suggest to the chairman of the gas committee that it would be advisable, in the interests of the concern, to appoint an engineer and works manager to look after the manufacturing side, and a distribution engineer and sales manager to control the commercial branch.

I pointed out how large a sum was spent annually at the works for material and wages; how necessary it was that the men in charge of the works should be located there; and that it was unreasonable to expect one official to devote adequate attention to the details of the two departments. At once came the reply, "That would be creating a new office!" "True," I answered, "but the circumstances require it." Then the bogey of "dual control" was raised, and the difficulty of drawing a line between the duties of the works manager and those of the sales manager, and so on. I then handed to the chairman a letter I had received from a well-known man in the profession, in which, referring to my scheme, he said: "If they carry out your ideas, the show will be managed as it has never been managed before." After an hour's discussion, the chairman seemed to be half-converted to my suggestion, and he promised to mention it to one or two of his colleagues. A few weeks later an advertisement appeared inviting applications for the post of engineer and manager, with full control of the manufacture, distribution, and sale of gas! In view of the policy of the administrators of this particular undertaking, it is not surprising that considerable dissatisfaction exists among the consumers as to the price charged for gas. Truly, as you, Sir, observe, "Incapacity is not only found at the gas sales end of some undertakings; it is seen in the administration quarters."

I suppose there are not more than thirty or forty gas undertakings in the country whose size would justify the appointment of a sales manager as one of the chief officials. But there are many where an energetic and properly qualified sales superintendent would find ample scope for his activities, and afford much-needed relief to the often harassed engineer and manager. Even in the smaller concerns, where a keen eye has to be kept on all expenditure, a tactful and well-informed inspector, told-off for the

special purpose of attending to the lighting and heating wants (and possibly whims) of the consumers, would earn his wages many times over.

The importance of promptness in attending to orders and complaints cannot be exaggerated; and yet in how many places is it overlooked! Not long ago, I requested a gas company to furnish me with an estimate for certain fitting work—including the laying-on of piping to three gas-fires. A fortnight elapsed before the estimate was received; and then I was told that the work could not be put in hand for at least three weeks. As time was pressing, I requested an estimate from a gas-fitter. A man was sent the next day; the morning following I received the estimate (which was considerably less than the company's); and within three days of my acceptance of the quotation the job was completed. On another occasion, and in another town, half-a-dozen men fiddled about the work before it was finished; and when the bill was rendered it was in excess of the estimate. Could any private tradesman escape the Bankruptcy Court if he pursued such extraordinary methods?

Then, too, better use should be made of gas and other demand-notes as advertising media; and the wording of the advertisements should be varied from time to time. If there is no one in the office who is good at drawing-up telling "ads.," a few guineas paid to an expert would be money well invested; and as few people trouble to read matter on the back of bills, it is a good plan to utilize part of the face of the accounts for advertising purposes, relegating to the back some of the unimportant notices which often occupy so large a space on the forms.

One word more. Gas offices, including the principals' rooms, should be warmed by gas-fires. I had occasion recently to call upon the engineer of an important company, a gentleman I have known for many years. On a side table was a large assortment of attractive pamphlets on the convenience and other advantages of gas-fires; in the grate a coal-fire was blazing regardless of expense. Pointing at the pamphlets and then at the fire, "Precept and practice," I said. "Do as I say, not as I do." My friend smiled and shrugged his shoulders. The next time I called, a gas-fire glowed upon the spotless hearth. "A word to the wise is sufficient," I remarked in my fatherly way.

INSTITUTION OF GAS ENGINEERS.

Candidates.

At a Meeting of the Membership Committee of the Institution of Gas Engineers, held at No. 28, Grosvenor Gardens, on Monday, Dec. 12, the following were approved as candidates:

For the Class of Member.

Clark, R. J. H., Chief Assistant Engineer, Plymouth Gas Company.
Cooper, J. E. L., Engineer, Manager, and Secretary, Yeadon and Guiseley Gas Company.
Peel, Fred., Gas and Water Engineer and Manager, Tyldesley.
Rendle, C. F. W., Engineer and Manager, Gas-Works, Redditch.
Robb, James, Engineer, Managing-Director, and Secretary, Chepstow Gas Company.
Robinson, George, Engineer and Works Manager, Gas-Works, Pinner.

For the Class of Associate Member.

Bullen, A. E., Second Technical Assistant, Plymouth Gas Company.
Ingram, L. P. (formerly a student, and late Corbet Woodall Scholar, Junior Assistant Engineer and Chemist, Plymouth Gas Company.
Smith, T. B., Coke-Oven and Bye-Products Works Manager and Chemist, Stocksbridge.
Widlake, H. C., General Engineering and Electrical Assistant, Plymouth Gas Company.
Wikner, S. A. W., Manager of the Bye-Products Works of the Newcastle and Gateshead Gas Company.

Transference.

Kinneir, H. H., Engineer, Gas-Works of the Great Western Railway, Swindon, recommended for transference from the class of associate member to that of member.

The next meeting of the Membership Committee will be held on Monday, Jan. 9.

SMOKELESS FUEL.

The remarkable improvement in the state of the atmosphere which resulted in all our towns and cities from the recent coal strike and the consequent stoppage of the burning of raw coal, has stimulated the imagination of many. Technicians and the lay public in every community of the country all recognize what a fine achievement could be secured if, by the use of some inexpensive smokeless fuel, our atmosphere were left unpolluted, and the pall of sun-obstructing smoke removed for ever.

We know of several inventors who are now working away most assiduously at the problems involved. There appear to be grounds for the belief that they will eventually succeed in their endeavours. But there may be interests unfortunately acting contrariwise. Is it not time that a vigorous national campaign were instituted, to be continued until "Merrie England" with Old Sol shining benignly upon its inhabitants everywhere—in town and country—shall be restored to the happy condition of the days before "sea-coal" came into general use?

Of course, we owe our industrial position to the possession of this valuable mineral—now the life-blood of the country; but surely we need not consume it on unintelligent lines, and without regard to the amenities of the healthful life of the Briton whose country it is. It has been proved that the public can really get along without burning crude coal. This being so, before the fact is forgotten and a general return is made to the extravagant methods of the pre-strike period, we should certainly leave no smokeless fuel proposition untried.

While smoke is emitted from our manufacturers' chimneys in large volumes, the aggregate volume emanating from the tens of thousands of domestic hearths is responsible for a large proportion of the smoke nuisance. We must not hope for reform by Act of Parliament. Such a procedure would be contrary to the spirit of freedom and that liberty of the subject, upon which the Britisher very rightly prides himself. No; it must be by means of a persuasive campaign, showing him the inconsiderateness of his conduct in vitiating the atmosphere, and by sweet reasonableness—leading him to adopt the use of a fuel from which the elements of smoke production are entirely absent.

Among the attempts to solve the problem may be mentioned that devised by Mr. Walter Strafford, who has spent years in closely studying all the practical and theoretical phases of the subject. The result is that he has produced a substance which he calls "Fuelite." An experimental plant has been working at Hampton, on the Thames, for some time; and the signed certificates of the engineers concerned go to show that to him is due the credit of inventing from refuse material a good smokeless fuel for domestic use, and excellent coke of any degree of quality, according to the particular purpose to which it is to be applied. Even hard coke suitable for metallurgical operations, including the conversion of ironstone into pig iron, can be turned out.

The particular feature of the apparatus is that it will deal with very inferior refuse from coal deliveries, &c., which are otherwise of no value whatever. An instance may be given of the treatment of 24 tons of such refuse, from which, after the admixture of tar, 25 tons of "Fuelite" was produced. Its certified calorific value was 13,556 B.Th.U. per lb. The result of dealing with a quantity of coke dust was 12,952 B.Th.U. per lb. By means of a disintegrator, the refuse is first ground-down to about ¼-in. particles. It is then mixed with crude tar, in suitable proportion—viz., the proportion employed with the mixture which gave the above calorific results. Pressed into open trays about 18 in. long and 7 in. wide, coupled in the form of a chain, the mixture enters the carbonizing retort, and is gradually drawn through. The retort consists of a 9-in. steel pipe 50 ft. long. It is heated by crude tar, which is stored in an overhead tank 12 ft. above.

The process is readily applicable to the existing retorts of any gas-works. Indeed, at the present time an installation is being proceeded with at such a works in the South of England. Special mention must be made of the tar burner heating the material, as it is upon this appliance that the success of the plant is largely due. It is supplied with injection steam through a ¼-in. pipe from a small boiler close by. The tar is admitted from a pipe of 2½-in. dia., the air-supply pipe being 6 in.

In the accompanying drawings, fig. 1 is a longitudinal section, and fig. 2 a front elevation of the burner. It is capable of being cleaned while at work, and can be quickly dismantled. The body consists of a hollow T-piece (*a*) through which air is drawn. The tubes *g* and *h* are fixed concentrically in a metal plug or closing-disc *b* screwed into one end of the casting; the nozzle ends of the tubes terminating at a point near the opposite end of the casting. The burner tubes are coupled with the steam and fuel-supply pipes by two junction pieces *c d*, which are bolted together, and also secured on the end closing-plug of the T-piece by bolts *e f*, so that it is easily detachable. The junction piece has a circular boss or projection which fits into a corresponding control aperture of the screw-threaded closing disc or plug, and is formed with a screw-threaded bore for the reception of the oil tube *h* which is adjustable in it. There is also a screw-threaded counter-bore for the reception of the steam tube *g*, in which the oil tube is adjustable longitudinally, and maintained concentrically by a collar *t* grooved for the passage of steam.

Oil and steam pass to the oil and steam tubes through passages *k* in the junction pieces communicating with radial inlet holes in the respective tubes. For adjustment purposes the outer end of the oil tube, which is in the form of a hollow spindle, projects outside the junction piece and has a square end for turning and a lock-nut *s* for fixing, after adjustment has been made. This end of the oil tube is closed by a screw plug *r*, which is removable to enable the tube to be cleared by the insertion of a wire or rod. At the nozzle end, the adjustable oil tube is tapered and enters a corresponding internally tapered outlet in the end of the steam pipe, on which a hollow cylindrical nozzle-piece is screwed at *o*. In the outer end of the nozzle-piece is a ring of holes *n* surrounding a cone *i* fixed in the nozzle-piece, and projecting with its apex into the interior of the nozzle-piece.

The fuel and steam supplies are regulated by ordinary valves fitted in the supply pipes. Under the injector cone of the nozzle at *v* the oil is caused to impinge on the cone in the nozzle-piece, where it is thoroughly atomized and intimately mixed with the steam before issuing in a coniform stream and mixing with the

Fig. 1.

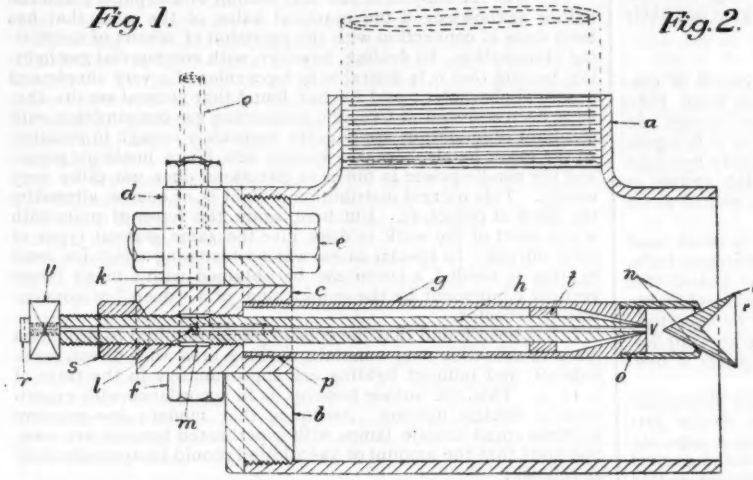
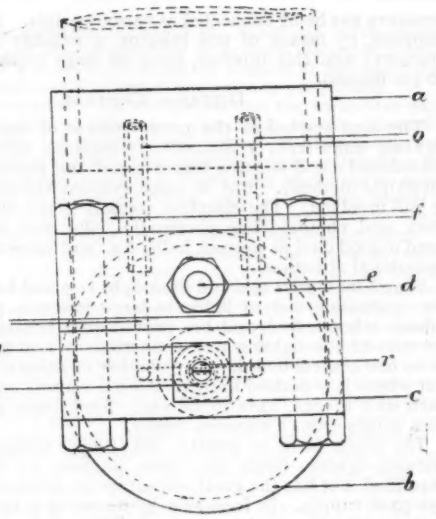


Fig. 2.



THE STRAFFORD OIL-FUEL BURNER.

air. The combustion is thus greatly improved as compared with existing burners, while the deposit of unburned fuel and the formation of hard carbon deposits in the retorts are avoided.

The degree of temperature worked on Mr. Strafford's plant can be adjusted to suit the quality of Fuelite it is desired to produce. The tar mixed with the coal-dust really becomes coked in the process, and pitch can be mixed with the material to form a bonding. An outlet for pitch and tar—a matter of great importance to the gas engineer just now—is thus made available for them.

It is to be hoped that the price of the product when placed on the market will be such as to commend it; for of course on this will depend its general acceptance by the householder and the manufacturer. As to its efficiency in use there appears no possible doubt whatever.

A plant of 100 tons weekly capacity is now being erected at the works of the Fuelite Company, Ltd., Oldfield Road, Hampton-on-Thames. In this case, producer gas will be used for heating the retorts.

GAS LIGHTING IN RELATION TO ILLUMINATING ENGINEERING.

The members of the Illuminating Engineering Society, meeting at the Royal Society of Arts on Tuesday of last week, had before them a paper by Mr. W. J. SANDEMAN, of the Croydon Gas Company. The paper dealt with the "Progress of Gas Lighting in Relation to Illuminating Engineering;" and the extensive character of the contribution was evidence that the progress that has been made has not been of a restricted order. Unfortunately, Mr. Sandeman was indisposed, and so unable to be present to read the paper for himself; but he had a well-qualified deputy in his assistant—Mr. W. A. BISHOP, who, as a matter of fact, was responsible for much of the technical data in the paper.

INVERTED BURNERS.

The first part of the paper reviewed the general development of gas lighting from the flat-flame burner onwards, until we reached the beginning of this century, when inverted burners made their appearance. Regarding these, the author stated that, on average present-day gas an efficient and well-adjusted inverted burner should yield a duty of about 20 candles per cubic foot. For the three sizes mentioned, the consumption and candle power at 30-10ths pressure are approximately as follows: "Universal" 4·5 c.ft., giving 90-candle power. "Medium" 3 c.ft., giving 60-candle power. "Bijou" 1·5 c.ft., giving 30-candle power. Larger, smaller, and intermediate mantles can be fitted to appropriate burners. For passages, staircases, &c., there is now available a very efficient burner and mantle consuming 1 c.ft. per hour, and yielding 20 candles. The larger (No. 6) mantle, introduced in 1912, and used in twos, threes, and fours, was regarded as the most advanced form of low-pressure gas-lamp (until the recent adoption of superheated burners carrying small mantles), and attained a maximum efficiency of 30 candles per cubic foot. Following the single inverted burner, multiple-burner lamps (two, three, four, five, and six burners) using either No. 4 or No. 6 mantles (the number indicating the approximate hourly gas consumption in cubic feet) were introduced. Each burner was equipped with independent air and gas regulators.

INVERTED CLUSTER LIGHTS.

Perhaps the most interesting part of the paper was that dealing with inverted cluster lights, which represent the most recent development in low-pressure gas-lamp construction. The author pointed out the various features of these lamps, as follows: (1) The provision of a superheater through which the gas and air mixture passes to the burners in a pre-heated condition. (2) The employment of small mantles in "cluster" form. (3) The use of a single gas and air-regulator for the whole of the burners.

It is now an accepted fact that such pre-heating leads to higher flame temperature, and hence to increased mantle luminosity.

The use of a series of small mantles in a cluster, in preference to a single big mantle, has also advantages. Small mantles have proved superior to big ones, chiefly for the following reasons: (*a*) The strength, and hence the life, of a mantle is in inverse ratio to its size. Maintenance records prove that the average life of a No. 2 mantle is appreciably longer than that of a No. 4 or No. 6. (*b*) There is considerable disparity between the shape of an inverted bunsen flame and the shape of a mantle, and the larger the mantle the smaller is the proportion of its area that is brought to full incandescence. Recognition of this fact has led to the general use of No. 2 mantles, which are proportioned to closely fit the normal flame and deflection of an inverted burner. Hence a second advantage of the small burner is its greater efficiency. Again, the small flames are short and stiff (approximating to a blow-pipe flame), while the larger flames have a distinct tendency to oscillate. This fact of increased "steadiness" is another point in favour of the small mantle.

The advantage of having a single gas and air regulator to control a group of mantles (instead of one for each) is that a slight turn either way suffices to bring the whole lamp into its best condition. Regulation difficulties are accordingly reduced to a minimum, and accurate gas and air mixtures are readily ensured. "Cluster-lights" of this type are now widely used for both indoor and outdoor lighting. Experience has shown that the cost of maintenance of such a light is less than would be the case for single large burners of similar total candle power, partly on account of the greater strength of the small mantles, and partly on account of the saving of glassware maintenance, as a cluster can be equipped with a single large globe.

Generally speaking, it has been found at Croydon that multiple-burner lamps with small superheated mantles are about 40 p.ct. cheaper in regard to maintenance, and give the same candle power on 50 p.ct. less gas than would be used by upright burners. In the latest forms of low-pressure lighting units, a duty of 40 candles per cubic foot has been attained, through the employment of superheated multiple-burners carrying small mantles.

HIGH-PRESSURE GAS LIGHTING.

The author next dealt with the question of high-pressure lighting, using either gas under pressure or applying pressure to a mixture of gas and air. The latter method is illustrated by the "Selas" system, of which, however, Mr. Sandeman has not had experience. This led him to refer to the Keith system, the principles of which he explained. Then he remarked that, in addition to its provision of extra aeration, the "Keith" lamp is fitted with a fixed gas-nipple, specially long mantle, and an air regulator, and is designed to embody all the three methods of intensification—viz., (1) Increased gas consumption for a given size of mantle; (2) more complete primary aeration of the Bunsen; and (3) pre-heating of the gas and air mixture prior to combustion. These features result in the highest efficiency yet attained in gas lighting—viz., 55 to 60 candles per cubic foot. An interesting development in the "Keith" system has been evolved for use in classes of factories where the air is apt to become filled with small solid particles in suspension. This duct system involves the use of tubes of fresh air, led in from outside the building; the high-

pressure gas being connected at various points. Each connection supplies, by means of one injector, a number of high-pressure burners; and this injector, being of large capacity, is not likely to get choked.

DISTANCE CONTROL.

The next section of the paper treated of the control of gas-lighting units from a distance. Numerous devices have been introduced; and mention was made of the platinum sponge and electrical methods. But in most systems the use of a bye-pass is still involved. The simplest method is the ordinary bye-pass cock and chains. The pneumatic valve and switch system is used a good deal in houses, halls, &c., and answers well, if given occasional attention.

Sugg's mercurial seal and flash-light cup-and-ball is much used for controlling distant lights in large interiors (churches, halls, offices, schools, &c.), and has proved quite reliable. This device permits of the lighting and extinction of any number of lights from one control board. Any number of units can be operated; but where it is desired to sectionize the control, separate supplies, each with a cock, have to be run. Each lamp requires a bye-pass supply from a common feeder.

The latest form of control—viz., Sugg's automatic diaphragm distance-lighter—fulfils the same purpose as the device just described, but has the great advantage of eliminating a separate bye-pass supply. It functions by means of a two-holed control cock, which allows, when in the "off" position, sufficient gas to pass (without raising the leather diaphragm valve off its seating) to keep the bye-pass going. The length of the bye-pass jet is regulated by a set-screw. When in the "on" position, the full bore of the cock permits of an increased pressure of gas, raising the valve to shoot-out momentarily the flashlight (which reduces at once to a tiny bye-pass jet when the lamp is alight) and pass the full supply of gas to the burners. This ingenious device has answered very well, and has had numerous applications. In particular, it is a great convenience to tradesmen who wish to control their outside lamps from the interior of the shop.

Referring to the control of high-pressure lamps, Mr. Sandeman mentioned that he had just commenced an installation of thirty large units—1500 and 1000 candle power—in an iron-works; and he pointed out that the lighting and extinction can be conveniently effected by Keith's special control device.

GLASSWARE AND FITTINGS.

Under this heading, the author was also able to show marked advances; and he pointed out that, by proper design, it is possible to obtain practically all the conditions aimed at with electric lighting. For example, semi-indirect lighting has been widely used during recent years, and can be applied with particular convenience to cluster lighting. As, however, all illuminating engineers are aware, it is not always easy to induce consumers to adopt fittings that screen the light and distribute it in the approved manner. At Croydon, it has been the practice to emphasize the great advantages of eliminating glare even though some absorption of light may be occasioned. In general, the author considers that, for low-pressure superheated "cluster" lighting, an average efficiency of 35 to 37 candles per cubic foot (mean lower hemispherical) may be expected when clear-glass globes and enamelled steel reflectors are used. If lightly "frosted" globes are substituted, the efficiency becomes about 31 or 32 candles per cubic foot. About the same duty is derived from lamps equipped with circular and octagonal opal reflectors and clear-glass globes. Slightly less duty is obtained by employing partially "frosted" globes (usually lower half) in conjunction with opal reflectors, and as this is the system of lighting most generally adopted at Croydon for direct illumination, it may be of interest to say that calculations are made on the basis of 30 candles per cubic foot, which has been found in practice to be a fair average efficiency. The average efficiency of units with pear-shaped "frosted" globes (as adopted for church lighting) is of the order of 25 to 28 candles per cubic foot.

It was pointed out in this connection that the variations of values given by different types of glassware are often overlooked; estimates of resultant illumination being based on the duty obtainable from unscreened mantles. At this point emphasis was laid upon the importance of polar curves of light distribution of units being more generally furnished by lamp manufacturers. The introduction of vitreosil heat-resisting glassware is alluded to as a noteworthy development. It is now being widely used not only for high-pressure, but for low-pressure lighting. In spite of the relatively high initial cost, the use of vitreosil chimneys and globes is amply justified by reduced costs of maintenance. The fact that the material can be brought so close to the mantle leads to compact design; and the translucent surface, which diffuses the light, but conceals the actual shape of the mantle, is often of value in enabling an inverted burner to be introduced into an upright fitting. In passing, the author mentioned one interesting feature of this glassware. It is possible to place mantles in closed globes having only narrow slits at the side through which air can penetrate. Globes of this description are particularly valuable in cases where it is desired to avoid possible dropping of hot parts from the mantle. Emphasis was likewise laid by Mr. Sandeman on the importance of constant pressure in connection with incandescent gas lighting; and he also urged that every endeavour should be made to induce consumers to discard upright burners in favour of the inverted type.

SIMPLE ILLUMINATING ENGINEERING DATA.

This was the subject of the next section of the paper; and the author acknowledged the practical value of the work that has been done in connection with the provision of means of calculating illumination. In dealing, however, with commercial gas lighting, he said that it is desirable to have rules of a very simple and practical character; and he has found that general results that have been deduced at Croydon connecting gas consumption with resultant illumination apply quite accurately enough in practice. In the lower hemisphere, the mantle acts like a luminous point; and the candle-power in different directions does not differ very widely. This natural distribution of light is, of course, altered by the effect of reflectors. But here, again, the types of units with which most of the work is done give the same general types of polar curves. In special cases, when a focussing effect for local lighting is needed, a curve can be obtained with a much larger vertical component by the employment of a "deep" or concentrating reflector.

It has been found that the consumptions required to produce a given illumination over a certain working area with direct, semi-indirect, and indirect lighting are approximately in the ratio of 1, 1½, 2. This, the author believes, is in accordance with experience in electric lighting. Assuming that modern low-pressure multiple small mantle lamps with superheated burners are used, one finds that the amount of gas allotted should be approximately as follows:

System of Lighting.	Consumption in Cubic Feet of Gas per Foot-Candle per Square Foot of Surface Illuminated.
Direct lighting	0·008
Semi-indirect lighting	0·012
Indirect lighting	0·016

Bearing in mind the efficiency attributed previously to high-pressure gas lighting, it would seem that with direct lighting of this description 0·0053 c.ft. per foot-candle per square foot illuminated would be a fair value. This is approximately equivalent to a duty of 45 candles per cubic foot. With semi-indirect and indirect methods, the allowances would be increased in accordance with the proportions indicated above.

SPACING AND FOOT-CANDLE VALUES.

The above method of calculation assumes that we are aiming at the production of a uniform illumination over the working area, and this in turn assumes a proper method of spacing units. For each type of lighting unit, it seems to the author highly desirable to provide appropriate spacing rules; and he thinks it is a matter to which manufacturers of gas lamps should give immediate and earnest attention. The author dealt with this question as well as with that of heights, and then went on to refer to the question of illumination values in foot-candles. He finds that in the Croydon installation the range of illumination, according to the purpose served, is from about 1 to 6 foot-candles. The upper values 4½ to 6 foot-candles are considered a super-effect necessary where work of a fine character is done. Even these super-values may be exceeded when local lighting for very fine operations is adopted. In such cases supplementary top lights are provided out of the normal range of vision, giving a general illumination of about 0·5 foot-candle, which prevents the contrast between the brightly lighted area under local lamps and the general brightness of surroundings being too severe. This subject was dilated upon by the author, who then passed on to consider the question of avoidance of glare, in which connection he said it is certainly desirable to avoid any completely unscreened mantles within the direct range of view; and it is also bad practice to leave the upper part of a room in complete obscurity, as is apt to happen when opaque reflectors are used. In schools and other places where the use of glass in overhead lights is considered undesirable and even forbidden, one can construct metal reflectors with a top-gap through which a certain proportion of the light passes to the ceiling.

STREET LIGHTING.

The next part of the paper treated of street lighting. Stress was laid on the importance of uniformity of effect, and avoidance of severe contrasts, in the interests of traffic. In regard to low-pressure lighting, the ordinary lantern with inverted burners and porcelain reflector is still quite an efficient device for side streets. Here, again, the substitution of inverted mantles for upright ones, and the use of cluster lights, have proved very beneficial. Multiple superheated small mantle lamps are becoming very usual for lighting main thoroughfares, and are certainly efficient and economical in maintenance. They are best placed at a height of (say) 15 ft. for a four-burner unit yielding about 350-candle power. As to high-pressure lighting, some of the examples of London streets so treated are admittedly among the best lighted in the world. The author urged, however, that in this matter of street lighting, the industry should not be content to rest on its oars. The design of the ordinary street lantern has remained substantially the same for a considerable time; and little attempt has been made to screen the mantle, and produce a softer and more pleasing effect, or to modify the natural curve of light distribution, which, with the wide spacing inevitable in street lighting, leads to great variations in the illumination furnished between the lamps. Mr. Sandeman thinks that in the main streets of London we might well aim at the use of lamp-posts and lanterns of a more distinctive pattern—such methods,

for instance, as the use of multiple-lamp standards with sources enclosed in light-diffusing globes. Again, assuming that suitable heat-resisting glassware is available, why should not internal "diffracting" devices be designed for the purpose of altering the distribution of light—such as are commonly used with electric sources? If this were done, gas suppliers would doubtless be able to provide minimum illumination values well above those existing at present, even in the most brightly lighted streets. Something more might also be done to develop decorative and imposing forms of bracket and pillar lights for use outside buildings of architectural distinction. This would act as an excellent advertisement for gas, and would be most valuable in yielding additional diffused illumination in important streets. In his view, too, gas might be applied more extensively to the spectacular and advertisement field of lighting by means of concealed lamps, signs, and bill-boards, &c. The author referred to the development of local parade lighting, or special external lamps outside shops. In Croydon, he mentioned, they use both six and eight light low-pressure lamps and 1000 to 1500 candle power high-pressure lamps for this purpose. The position of such lamps naturally depends on the frontage. As such lamps are very often used for the joint purposes of attracting attention and illuminating the interiors of windows, heights of 8½ to 10 ft. are usual. Some tradesmen prefer fitting these lamps with parabolic reflectors, thereby using them solely for window lighting, and having "top" lamps well above the facia for outside display and advertisement lighting—a very good scheme.

In the concluding part of the paper, Mr. Sandeman dealt with the lighting of halls, churches, schools, &c. We must pass over this particular part of the paper, but incidentally in the course of it we notice that reference is made to the lighting of factories, which has been the subject of inquiry by a Departmental Committee of the Home Office. These recommendations the author says may be regarded as the preliminary to future statutory requirements of adequate lighting in factories; and he urges that they should be closely studied by the gas industry. He is confident that, by the aid of modern developments, gas lighting will be able to satisfy such requirements completely, provided illuminating engineering methods are applied, and factory lighting is studied in a scientific way.

SOUND OPTIMISM.

In conclusion, the author said there is ample scope for gas lighting, if forethought is exercised for the future, if we are quick to adapt ourselves to new developments, and if the needs of consumers are scientifically studied. We must not be content to satisfy uninstructed public opinion, but must educate consumers in the principles of good lighting by adequate methods of publicity, among which demonstrations of efficient lighting play an important part. In the Croydon showrooms, a varied display of fittings has been intentionally arranged; and the method of lighting here adopted in the different rooms itself serves as an object lesson in the use of semi-indirect and other modern lighting devices. There has also been arranged side by side examples of obsolete and modern fittings, and properly shaded and exposed mantles, in order that consumers may judge for themselves the difference in effect. The Company also give attention to the needs of a consumer after his custom has been secured. In almost all cases, success has been largely attributable to the fact that, after completing the installation, the Company undertake the maintenance, and in general do everything they can to make a consumer feel he is getting good value for the gas he uses, and that he is guaranteed against failure or deterioration in the original conditions.

Then it is necessary to keep abreast of progress and to expend patience and trouble, both in encouraging consumers to discard obsolete fittings when new and better types appear, and in studying how these fittings can best be applied. Gas undertakings, therefore, should study illuminating engineering. They should have precise knowledge of the intensity and distribution of candle-power of the lighting units they use, and be able to predict the resultant illumination.

Finally, they should keep in mind the principle that what the consumer needs is not merely inexpensive lighting, but illumination that is adequate and suitable for his needs. In the past gas men have, perhaps, been too prone to emphasize the cheapness of gas as an illuminant; and people have come to assume that, if gas lighting is adopted, the costs of installation and fittings must be reduced to an absolute minimum—to a degree really prejudicial to the ultimate results obtained from the installation. Experience shows that the importance attached by the consumer to the quality of the lighting provided is much greater than was the case a few years ago; and he looks to the undertaking for guidance and information on the latest developments. This desire for service must be fostered in every way possible, and future success depends primarily on the completeness with which illuminating engineering methods are applied in the gas industry.

Mr. Sandeman expressed his indebtedness to the co-operation of his assistant, Mr. W. A. Bishop, by whom much of the technical data appearing in the paper was compiled. He added how much he appreciated the useful educational work Mr. Bishop has done in the matter of promoting a better understanding of the elements of illuminating engineering among the members of the staff.

Some Points from the Discussion.

Generally speaking, the discussion ranged over a number of details, which we need not enter into fully here.

The CHAIRMAN (Mr. F. W. Goodenough), in the first place, added the thanks of the members to those of Mr. Sandeman to Mr. Bishop for the work he had done in assisting to prepare the paper, and for having presented it in the much-regretted absence of Mr. Sandeman, who they all hoped would be speedily restored to good health.

Mr. A. E. BROADBERRY was of opinion that the instructive paper would become a work of reference. One lesson running through it was the desirability of treating these matters of illumination on a scientific and considered basis. He urged architects, in designing new buildings, to give gas engineers and illuminating engineers an opportunity of advising as to where different points of lighting should be arranged. He was quite certain they could give much better illuminating results than were often found in public halls and buildings.

Mr. A. CUNNINGTON (L. & S.W.R.) remarked that the paper frankly put forward the ideals of the Society, and showed that gas lighting could fulfil those ideals. Naturally (in view of the speaker's railway connection), the point of gas pressure was raised. His colleagues of the railway world had had difficulty in getting even 20-10ths pressure recognized as being the proper rate. He was glad to find in the paper that 30-10ths was really the sort of pressure one should have for useful work. An important point was the use of small mantles, in which field he thought the railway companies were entitled to take a little credit for being pioneers. This was now becoming general practice. One point about small mantles was that one size only could be used, and that was a matter of great importance. In his own case, they had found it very beneficial to standardize one size only. He protested against the use of lighting fittings at a height of only 8½ ft. This was too low for street and shop window lighting. He had seen a large drapers' shop in South London, where high-pressure gas-lamps had been raised well above the facia level and well out from the shop, so that the whole of the front surface was brilliantly lighted. People looking into the window had the bright light behind them, and a good light was sent into the windows. The whole arrangement was as simple as possible, and the effect was excellent. He spoke of glare as not only harmful, but wasteful. He proceeded to give information as to his practice of using a wind-proof lamp which Messrs. Sugg and Co. had designed for railway platforms. He had good testimony to give as to pneumatic control. The system had been in use on his Company's premises, and the arrangement had lasted for years.

Mr. STEVENS (L.N.W.R.) pointed out that, in the first part of the paper, Mr. Sandeman spoke of average present-day gas as yielding a duty of 20 candles. Present-day gas, he said, showed so much variation that "average" gas was rather difficult to define.

Mr. J. G. CLARK, at the outset of his remarks (putting them broadly), said, in speaking of efficiencies of light sources in modern practice, in his opinion the time had arrived to abandon the old title of candles per cubic foot per hour. A convenient title would be candle-hours per centi-therm; and, on a broad classification, modern gas units could be scheduled as follows:

Low-pressure upright. . . .	33	candle-hours per centi-therm.
,, ordinary inverted	42	,, ,,
,, cluster inverted .	63	,, ,,
High-pressure inverted . . .	100	,, ,,

These figures dealt with the sources of light. The suggestion could be extended to "efficiencies of utilization"—that was the amount of light that could be usefully directed to the working surfaces. Mr. Sandeman had set out the relative utilization efficiencies of direct, semi-direct, and indirect methods of lighting. He agreed with the values given, but the title—"Consumption in cubic feet of gas per foot-candle per square foot of surface illuminated"—was rather cumbersome. As it stood, it did not indicate any relation to the calorific value of the gas. Apart from this fact it was incomplete, because it did not show the rate of gas consumption. It should read: "Consumption in cubic feet per hour per foot-candle per square foot of surface illuminated," thereby becoming still more cumbersome—the volume of gas being differentiated no less than three times. A square foot illuminated to one foot-candle was numerically equal to a lumen; and he suggested that utilization efficiencies be stated in "Lumens per centi-therm per hour." This would give the following data:

System of Lighting.	Lumens per Centi-Therm per Hour.
Direct lighting.	255
Semi-indirect lighting	170
Indirect lighting	125

In regard to cluster lamps, he was in agreement with Mr. Sandeman as to the importance of substituting for ordinary inverteds lamps of the cluster type. There was no question that the substitution of medium cluster lights for three-light ordinary brought with it an increased candle power arising from the higher efficiency that was obtained with reduced gas consumption. But he emphasized the point that, to get the best results out of the cluster lamps, care must be taken to get mantles uniform in size. The gas industry ought to have a specification to provide mantles that would only vary within small limits. Among other points, he spoke of the importance of the education of the consumer in the matter of correct lighting.

Mr. S. B. CHANDLER observed that the paper was a timely one. It came at an opportune moment in the history of the industry, and proved that gas could meet any demand made upon it. The chief point that arose out of the paper and discussion was that when one had obtained a gas-lighting installation, the main thing was to keep it; and maintenance was about the best thing to that end. With regard to the polar curves, he agreed with Mr. Sandeman that it was highly important that manufacturers should give (without and with shades) polar curves in their catalogues. The characteristics of the different lamps would then be a great guidance to illuminating engineers, and would materially assist them in working-out schemes. With regard to high-pressure lighting, he gave some particulars of an instance of a very large factory in South London in the area of supply of his Company. The Keith system had been put in—about 300 units, and approximately 50,000 candle power. The point aimed at was to spread this illumination over five floors. This had been accomplished by proper scientific placing of the lamps, and carefully designed shades, with the result that each floor was evenly illuminated. Altogether it was a very fine job. The

machine shop was illuminated by three No. 2 lamps in the same way. As tested by the "Lumeter," the illumination in the shop was between 3 and 4·5 foot-candles.

Mr. W. J. LIBERTY believed that the multiple burner was going to take gas lighting a long way ahead. It was clear from his remarks that he, too, is a strong believer in the No. 2 small mantle, because it fits the flame, or the flame fits the mantle. He is also a strong advocate of preheating with cluster burners. On London Bridge, there were "Kempton" lamps with two 5-light clusters and superheaters The consumption was a little under 3 c.ft.; and small mantles were used. On Blackfriars Bridge, there were 5-light clusters with preheaters. The consumption was the same as on London Bridge—each 5-light cluster consuming about 14 c.ft. per hour. In each of these cases, the regulator was inside the lamp, so that the maintenance man could by opening the door make the necessary adjustments easily, and without inconvenience; whereas, if the regulator was at the top, it was too hot for him to manipulate. With these preheated multiple burners, by having small mantles they got a mantle really full of flame. There seemed to him with this system to be no end to the number of burners they could get into a lantern. He had some centrally suspended across a city thoroughfare, containing sixteen preheated burners in clusters of eight burners, with small mantles, giving 1000 c.p., and suspended 26 ft. above the roadway. Maintenance on account of glassware was less with these lamps. In his opinion all upright and other burners should be scrapped and preheated burners should be put in. The lighting efficiency was increased with a lower consumption.

Mr. A. BLOK desired to know more about the candle-power ratings used through the paper; and he suggested that the figures should be reduced to a common rating in respect of a candle power, whether hemispherical or mean hemispherical. He also thought that some shorter unit should be arrived at—lumens per therm or centi-therm would be ideal. The only satisfactory unit was the total light output of a lamp, which could only be expressed as flux or luminous energy. He heartily welcomed the paper, because it was but quite recently charged against gas engineers that correct numerical data for gas lighting were not available. He congratulated the Croydon Gas Company on having people who could attack these questions on such progressive lines. He was privileged to see some of Mr. Bishop's earlier efforts in this connection; and it was extraordinarily satisfactory they should have, through the work of Mr. Sandeman and Mr. Bishop, simple guidance as to how to get-out lighting systems which would approximate closely to predicted values.

The CHAIRMAN said he had the same feeling as one or two speakers, —that attempting to discuss this paper was rather like discussing an encyclopædia. They were indebted to Mr. Sandeman for giving them this compendium of information with regard to gas lighting. He was rather interested to hear their railway friends' references to the question of pressure. Mr. Cunnington seemed to think there was some inconsistency between Mr. Sandeman's pressure and the position taken up by the gas industry when it came to a question of legislation. He (Mr. Goodenough) would just like to say on this point that what the gas industry was fighting in that case was the penal minimum pressure at any point in the area of distribution, which was a very different thing from the general working pressure in the district. To be asked to give a minimum pressure, with penalties attached, in a pipe of any size, and at the consumers' meters, was a different matter from giving such pressure in the mains and services as would give the consumer an adequate supply of gas. The railway companies or other consumers would have no reason to complain of the result of the provisions made in regard to gas pressure under the legislation as it stood. He could only say, as had been said on many occasions before, to their friends the railway companies, that every gas undertaking worthy the name desired to give to the consumers the pressure which would enable the consumers to get at all times the best out of the gas supplied. Reference had been made to the candle-power efficiencies given in the paper as if they were the maximum efficiencies on the polar curves. This was not as he (Mr. Goodenough) accepted it. He thought the figures referred to the mean hemispherical candle power. He also emphasized the great importance of educating consumers to purchase only burners and mantles of satisfactory quality. So-called cheap burners and mantles were among the worst enemies of gas lighting; and it was very important that the men of the gas industry should do all they could to educate consumers to the true economy of purchasing good burners and mantles, and particularly of placing the renewal of mantles under maintenance direct with the gas suppliers. Mr. Sandeman showed that the cost of maintenance was lower with a large number of small mantles, with the superheater burners, than with a smaller number of large mantles and burners of the older type. Reference had been made to the mercurial seal distance lighting for groups of lamps. The Gas Light and Coke Company put the system in at Victoria Station many years ago—perhaps twelve to fifteen years—and it had worked absolutely satisfactorily. It effected a considerable economy to be able to regulate the lights according to the requirements of the traffic. He also emphasized the importance of seeing that promise was confirmed by performance whether the installation was by gas or electricity. The best way to get the confidence of the consumer was to be sure that he was given something better than was promised. Mr. Stevens asked about the average present-day gas; and he (Mr. Goodenough) thought the best answer was given by Mr. Clark—the efficiency per 1000 B.Th.U.

Mr. BISHOP, in replying to the discussion, referred to Mr. Clark's point as to the candle power being stated per centi therm In each case, he (Mr. Bishop) had taken the gross calorific value; and if Mr. Clark would convert the calorific figures given in the table in the paper [the table is not given in our abstract] he would be able to arrive at what he required, so far as these tests were concerned. In Croydon, in common with other districts, they had experienced the bad effect of variations in the sizes of mantles. As to pre-heating, he did not think they had yet arrived at the limit of efficiency with 30 to 35 candles per cubic foot. The candle-power readings were mean hemispherical ones.

On the proposal of Mr. GASTER, hearty acknowledgment was made of the excellent work Mr. Sandeman, with the assistance of Mr. Bishop, had put into the paper.

THE "MINETTE" GAS-BURNER.

THE lower calorific grade gas which is now being supplied in the country, and which in all probability will become lower still, in the quest for manufacturing economy and lower cost per therm, will give to incandescent gas lighting a more cogent reason than ever for displacing flat-flame burners and substituting incandescent burners of small size and moderate consumption—particularly for places where a light is required of low intensity, and not for working purposes.

The latest arrival in the form of a small incandescent burner for this particular purpose is the "Minette," which the Bland Light Syndicate, Ltd., have put upon the market. It is a patented burner of the upright variety, but utilizing any bijou inverted mantle. The advantage of using an inverted mantle on an upright burner is the greater rigidity which the mantle with its fireclay ring possesses than the ordinary form of upright mantle, suspended on a prop carried by the burner itself, in which case vibration causes a considerable amount of fraying of the edges and destruction of mantles. Moreover, the use of an inverted type mantle in this way maintains the mantle in an absolutely central position over the gas-flame, so that a constancy of efficiency is assured, providing the other conditions necessary to uniformity obtain. In the interests of the users of flat-flame burners, it is also preferable that there should be conversion from the one form of burner to the other, in view of the fact that, with the present very general gas supply the incandescent burner will give about eight times more light than a flat-flame at about one-sixth of the consumption of gas. Such a burner we have in the "Minette." With gas of (say) 475 B.Th.U., the consumption is not more than 1·9 c.ft. per hour, at a pressure of 25·10ths. We are informed that it is quite possible for the burner to be turned down to the lowest consumption without the possibility of firing-back or smelling. With a burner of such low consumption, the places where it can be constantly used during the hours of darkness and requirement are, of course, countless. This makes it particularly suitable for lavatories, landings, bathrooms, nurseries, &c. The cost is small—the price of the burner and the gallery being only 1s. 3d. (mantles and globes extra).

This "Minette" burner is the one referred to in our list of patent applications on Dec. 7, under the names of Mr. R. J. Rogers, and the Bland Light Syndicate, Ltd. (patent No. 31,063 of this year). The burner is of good design, and well made; and the new conditions that apply to-day to gas supply will ensure a substantial public demand for it.

The Summers Low-Temperature Retort.

Mr. J. D. Davis (Fuel Chemist of the United States Bureau of Mines) dealt with carbonization at low temperature in the recent report of the Carbonization Committee of the American Gas Association, and described several processes. Among them was the retort invented by Mr. L. L. Summers—a continuous low-temperature retort designed specially for producing a dense coke by compressing the charge. A plant on these lines is being erected at Hamburg (Ill.). Briefly, the Summers retort consists of a horizontal coking chamber built of masonry about 40 ft. long and of rectangular vertical section, 17 in. wide by 27 in. high. On the floor of the retort is a reciprocating iron conveyor extending throughout the retort length. A heavy cast-iron fin attached to the conveyor serves to take the raw coal from a hopper at one end of the retort, and force it forward towards the other end, where it is discharged through a water-seal as coke. The conveyor is actuated by a powerful hydraulic ram. Heating is effected in large flues running horizontally through the retort side-walls; and built-in regenerators are located at the top. Running along the roof of the carbonizing chamber is a channel, which serves to assemble the distillation vapours and convey them to a standpipe and hydraulic main located at the feed-end of the chamber. Provision is made for shifting the zone of the highest temperature to any desired section of the oven walls, so that the heating of the charge can be well controlled. The yield of oil is said to be much greater than that obtained in high-temperature processes; and at the same time a large yield of good gas is realized.

There has been received from Washington a copy of Technologic Paper No. 193 of the United States Bureau of Standards, on the subject of the "Design of Atmospheric Gas-Burners." The authors are Messrs. Walter M. Berry, I. V. Brumbaugh, G. F. Moulton, and G. B. Shawn, who present the first part of an extensive investigation. It is stated that with the arrangement of apparatus and method of testing that has been developed, one can measure quickly and accurately the volume of air injected into any burner under any condition of operation, as well as determine the limits of operation with any quality of gas. The authors' researches have already been noticed in the "JOURNAL."

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

A Short Paper Evening.

The monthly business meeting of the Association, held last Friday evening at the Westminster Technical Institute, S.W.—under the presidency of Mr. FREDERICK A. FROST, of the South Metropolitan Gas Company—was of a character which has proved deservedly popular with the members. It was devoted to the reading and more or less question-and-answer discussion of three short papers on topical subjects. The papers, with summarized reports of the discussions, will be found on this page *et seq.* The authors and titles were as follows:

Mr. T. V. JOHNS (Richmond Gas Company), "Notes on the Composition of Various Grade Gases."

Mr. LEONARD LACEY (Gas Light and Coke Company), "Notes on Coke-Handling Plant."

Mr. FRANK J. PEARCE (North Middlesex Gas Company), "Some Notes on Ascension Pipes."

The PRESIDENT, in opening the proceedings, remarked that the Council were pleased to have been able to arrange so interesting a programme. They had always felt that contributions submitted by their own members should form as prominent a feature as possible of their meetings.

The authors were thanked for their contributions, on the proposition of Mr. D. C. CROSS, seconded by Mr. E. E. CALVERT.

PRESENTATION TO SUCCESSFUL CANDIDATES.

The PRESIDENT said those present would be pleased to know that at the City and Guilds of London examination in "Gas Supply" and "Gas Engineering" two of the members of the Association were in the honours list; and the Council thought that such an event should not be allowed to pass without the bestowal upon the successful candidates of some tangible mark of appreciation of their efforts. Anticipating the concurrence of the members in this view, it had been decided to present to each a suitable technical work. He then handed a copy of Hole's "Distribution of Gas" to Mr. David W. Evans (South Suburban Gas Company), who received the silver medal in the "Gas Supply" final examination, and a copy of Newbigging's "Handbook" to Mr. Edwin C. Nash (South Metropolitan Gas Company), who was awarded the silver medal in "Gas Engineering."

Both recipients suitably acknowledged the gifts.

COMPOSITION OF VARIOUS GRADE GASES.

By T. V. JOHNS, of the Richmond Gas Company.

[A Paper read before the London and Southern District Junior Gas Association.]

In bringing before the members of this Association a few observations on "Gas Compositions" for discussion this evening, I wish to say at the outset that they are of a purely theoretical nature. I am principally concerned on the manufacturing side; and in saying this, it is for the benefit of those distribution engineers among us who might have expected some practical results. Of these I have none. The excellent researches carried out by the Gas Investigation Committee upon the relative efficiencies in use of different grades of gas have furnished us with results the integrity of which it would be difficult to surpass. New light has been thrown on the combustion of gases in different appliances by experimenting upon varying qualities between the limits of approximately 250 and 550 B.Th.U. per cubic foot.

Having had presented to us this extensive information, it must be gratifying to those members of the industry who for long years had speculated in their own minds upon the merits or demerits of different gases, and how best to apply them, that much previous hypothesis is now turned into fact. The primary object of a gas undertaking is to supply gas to the public. Granted then that this is its principal commodity, there are so many points in connection with the physical, chemical, and thermal properties of gases that to have a proper conception of a mixture, one should study each particular component separately; and, in summing-up the character of the whole, the influence of each separate constituent has to be considered according to the percentage of it that is present in the mixture.

To begin with, the chief constituents of either coal gas, water gas, or producer gas can be summarized as: Hydrogen, methane, carbon monoxide, ethylene and other hydrocarbons, oxygen, nitrogen, and CO_2.

In discussing the total hydrocarbons in gas, it must not be thought that because they are only present in small percentages they are relatively unimportant, because it has to be borne in mind that the luminosity of a flame depends on them—H_2, CH_4, and CO all being non-luminous. I mention this matter particularly because some time ago an advocate of low-grade gas claimed that of two gases of the same calorific valus, the one containing a greater percentage of inerts was much better than another containing a much smaller percentage (20 p.ct. less) when examined side by side in flat-flame burners. But when the compositions of the two gases were revealed, the reason that the higher inert one looked better was obviously due to the fact that it contained just 100 p.ct. more hydrocarbons (other than methane)—the light-giving constituents. So far as incandescent lighting is concerned, we know that the percentage of unsaturated hydrocarbons is relatively unimportant; but I mention the matter because there still appear to be some who think that they are able to estimate a quality of gas by looking at a flat-flame burner. This can be estimated by experience when only one particular type of gas is being manufactured; but when two or three processes are involved affecting the composition of the ultimate mixture, then it is a different matter.

HYDROGEN.

Prof. Sexton says "The influence of H_2 in a gas mixture is to make it light and bulky; to add largely to its heating power; and since the specific heat of steam is very high, also to increase the amount of heat carried away in the products of combustion."

I wish also to read an extract from Dr. Harold Hartley's paper, read to members of the London and Southern Junior Gas Association: "It seems to me, however, a matter for regret that the gross calorific value of the gas should be employed, whereas the practice is now common to base all computations on the net calorific value. This is done because the latent heat of condensation of steam can so rarely be taken advantage of in heating processes." The Gas Referees claim, however, that "when steam escapes uncondensed, the uncondensable products of combustion also pass away at a high temperature; and since the loss of heat thus arising is commonly the greater of the two, the customary partial correction from gross to net has not much significance." Having regard to the diversity of these opinions, I have endeavoured to find out whether or not the net value is the better. It depends on the ratio of the hydrogen and methane to the total combustible products of the mixture.

I have chosen two gases which were tested by the Gas Investigation Committee.

	"A." (Coal Gas + Blue Water Gas.) P.Ct.		"B." (Coal Gas + Mond Gas.) P.Ct.
CO_2	5·1	..	13·3
O_2	0·8	..	0·3
HC	1·5	..	0·2
CO	18·9	..	10·3
H_2	39·5	..	28·0
CH_4	14·1	..	9·6
N_2	20·1	..	38·1
	100·0		100·0
Specific gravity	0·584	..	0·750
Inerts	26·0 p.ct.	..	51·7 p.ct.
Gross B.Th.U. per c.ft.	404	..	241
Net B.Th.U. per c.ft.	364	..	214
Ratio gross/net	1·105	..	1·125
B.Th.U. per c.ft. self combustible mixture (gross)	100	..	84
B.Th.U. per c.ft. self combustible mixture (net)	90	..	75
Ratio gross/net	1·11	..	1·12
B.Th.U. (gross) per c.ft. products of combustion	107	..	90
B.Th.U. (net) per c.ft. products of combustion	97	..	80
Ratio gross/net	1·103	..	1·125

The difference in the ratio values between the two gases, gross and net, in the products of combustion is—

$$1·125 - 1·105 = 0·02$$

Therefore the percentage difference is approximately 2.

I should also like to compare the "A" gas with another "C" gas (a straight coal gas and air):

CO_2	3·6
O_2	4·4
HC	2·1
CO	7·5
H_2	32·9
CH_4	22·0
N_2	27·5
	100·0

Gross 453 } Ratio 1·118
Net 405 }

Inerts 35·5 p.ct.

B.Th.U. { gross } per c.ft. self combustible mixture 104 { Ratio
" { net } " " " " " 93 { 1·118

Volume of products of combustion per c.ft. of gas 4·2 c.ft.

B.Th.U. { gross } per c.ft. products of combustion 109 { Ratio
" { net } " " " " " 97 { 1·124

"A."		"C."
1·103	..	1·124
		1·103
		0·021—*i.e.*, nearly 2 p.ct.

Ring-burner tests on these three gases were reported as:

"A"	Efficiency on net calorific value	55·8 p.ct.
"B"	" " " "	54·7 "
"C"	" " " "	53·5 "

If these two gases were sold in separate towns on the therm basis, the consumer buying the "B" gas would therefore not get quite so much value for his money as the purchaser of the "A" gas at the same price per therm, unless the whole of the steam produced in the combustion of each gas was condensed. With the new method of gas charging per unit of energy supplied, it is

customary to read that gas undertakings will be able to make a truer comparison of costs one with the other; but to be strictly correct, it would appear necessary to charge on the net heating basis of the gas supplied.

METHANE.

It does not seem to matter very much what the percentage of this constituent is, so long as the calorific value and obtainable intensity of combustion of the mixture in which it is contained is sufficient for all requirements. Two points need perhaps to be commented upon.

1.—It burns with a much longer flame than either hydrogen or carbon monoxide when combusted at the same rate; so that the height of a gas flame is more or less dependent on the mixture's methane content.

2.—It is a useful gas for power purposes, in that the volume of the products of combustion is the same as that of the mixture before exploding; whereas in the case of hydrogen or carbon monoxide when exploded with air the mixture contracts to 0·85 of its original volume, the explosion pressure being correspondingly reduced.

CARBON MONOXIDE.

It is well known that the chief advantage of supplying a gas containing a large percentage of CO lies in the fact that it produces a high calorific intensity when combusted. For high temperature work and raising mantles to incandescence, this is very necessary. In connection with the subject of lighting, the luminous efficiency depends on the temperature to which the oxides on the mantles can be raised, all other things being equal. It has been pointed out how imperfect are the various lighting devices now employed on a basis of scientific efficiency. The figures quoted show the relative energy that is expended in the production of light.

Source.	Percentage of Light.	Percentage of Non-Luminous Energy.
Coal gas	2	98
Incandescent burner	3	97
Arc lamp	10	90
Magnesium lamp	15	85
Cuban firefly	99	1

Compared with electricity (neglecting efficiency in production), gas is rather low on the list; but I think it would be interesting and perhaps helpful to the industry if researches were conducted into the efficiency of incandescent burners on gases containing from (say) 10 up to 40 p.ct. of CO, (*a*) using air as a medium, then (*b*) gradually increasing the percentage of oxygen in the air to the burner from 20 upwards, until a figure of maximum efficiency is reached. Theoretically, the calorific intensity should be much increased, and consequently the luminous efficiency.

CO AND N_2.

The influence of these inerts in different gas mixtures has been disclosed by the researches carried out. It has been stated that the influence of adding the same amount of CO_2 reduced the efficiency to a greater degree than if a corresponding amount of N_2 had been added. This is to be expected when it is remembered that the rate of increase in specific heat value with rise in temperature depends upon the complexity of the molecule, and a triatomic molecule of CO_2 is more complex than that of a diatomic nitrogen one.

In concluding these notes, it will be seen that I have not attempted to differentiate between the merits of high and low grade gases, either from a manufacturing or from a distribution aspect, when a mixture is taken as a whole, but only upon the general influence that each component bears to the mass. Too much discussion, however, cannot be had on the subject of gas quality; and in introducing it, I trust that some good may accrue from the general discussion.

DISCUSSION.

The PRESIDENT (Mr. F. A. Frost) said the paper dealt with a subject of ever-increasing importance to chemists, physicists, and engineers alike. The author, in his references to the two gases which came under review by the Gas Investigation Committee, pointed out that if these two gases were sold in separate towns on the therm basis, the consumer buying the "B" gas would not get quite so much value for his money as the purchaser of the "A" gas at the same price per therm, unless the whole of the steam produced in the combustion of each gas was condensed. This, on the face of it, was undoubtedly true; but, from the practical point of view, they must not overlook the possibility that the user of "B" gas might burn his gas to better advantage even than the user of the "A" gas. The opinion was expressed in the paper that charging on the net basis would be more equitable. Assuming for a moment that they did, he (the speaker) was inclined to think the matter might bear a very much more complex character than was the case at the present time. It might be pointed out that, when the latent heat of condensation of steam was utilized, they would be getting something for nothing, to the detriment of the other consumers. It occurred to him that, with the developments that were now taking place in gas appliances, they might even arrive at a time when they could get an efficiency that would be greater than 100 p.ct., if selling gas on the net basis. This would make the thing look rather ludicrous. He thought that, on the whole, they would be well advised to stick to reckoning gas on the total or gross value, and make this the 100 p.ct. standard which would be the goal to which makers of appliances would strive to get as near as possible.

Mr. C. WRIGHT (Gas Light and Coke Company) said that, as had been remarked, if they excluded the benzene series of hydrocarbons from the gas, the only remaining light-giving source was the unsaturated hydrocarbons of the ethylene group. He thought they were rather more important than perhaps appeared at first sight. What method would be adopted from a practical point of view to increase the amount of these unsaturated hydrocarbons in the gas, or, if they were considered undesirable, what steps would be taken to decrease the percentage?

Mr. JOHNS said that, working at high heats, they were split-up from 6 to 7 p.ct. down to 3 p.ct.; so that, in order to increase the unsaturated hydrocarbons in the coal gas, he should think the first thing to do would be to work at a lower temperature, and not split them up. Using cannel, one got from 8 to 9 p.ct. of ethylene. These would be the only two practical ways he knew of to increase the percentage.

Mr. D. J. WINSLOW (Lea Bridge Gas Company) remarked that, though carbon monoxide and hydrogen had both the same calorific value, from the consumer's point of view, as there was no water vapour produced from carbon monoxide, it seemed it was better value to the consumer to have this in place of hydrogen. Therefore gas richer in carbon monoxide than in hydrogen would be of a certain advantage, however slight, to the consumer. With regard to gross and net value, the makers of appliances still gave their figures on net values. It would, however, be better if they all came into line, and based their calculations on gross values. This represented the total heating value of gas; and if the apparatus was not able to make use of all this, it was rather the fault of the apparatus.

Mr. JOHNS said Mr. Winslow's suggestion was that carbon monoxide, owing to the fact that no steam was formed during its combustion, should be more efficient than hydrogen. This was so; but the effect was more marked in consequence of the reduction in methane content when water gas was added. Hydrogen during combustion produced its own volume of steam; whereas methane produced twice its volume of steam.

Mr. S. B. CHANDLER (South Suburban Gas Company) said the subject was of such importance that he would suggest that the President should allow it to come up for discussion again at some early meeting, after the members had had an opportunity of studying the figures in the Technical Press.

Mr. JOHNS, in reply to a question by Mr. WALKER, as to whether he would advocate a mixed gas with a high percentage of water gas, because of the extra hydrogen, said it would not make very much difference. In the straight coal gas the hydrogen was 40 p.ct.; and in the straight water gas it was 48 p.ct.

The PRESIDENT thought Mr. Chandler's proposal was a very good one. At some meeting in the near future they might have time to spare to be profitably utilized in further discussion of this subject.

NOTES ON COKE-HANDLING PLANT.

By L. LACEY, A.M.Inst.C.E., of the Gas Light and Coke Company.

[A Paper read before the London and Southern District Junior Gas Association.]

The subject I have chosen to introduce for discussion this evening is one with which the time at my disposal will only permit me to deal very briefly, and I shall confine myself chiefly to some remarks on the particular type of plant in common use by the Gas Light and Coke Company.

TYPES OF CONVEYORS.

In nearly all houses containing horizontal or inclined retort settings, the coke, on being discharged from the retort, falls into a hot-coke conveyor of the drag-bar type. The leading dimensions of this chain have now been standardized; and it is also extensively used in inclined and hopper conveyors. It is of the De Brouwer type, and, apart from modifications which have from time to time been introduced in the form of side links and blocks, is essentially similar to the usual pattern with which no doubt many of you are familiar. Its width from centre to centre of the side blocks is 2 ft. 1½ in.; the distance between successive cross-bars being 2 ft. 2¼ in. The pitch of the sprocket wheel teeth is 8¾ in.; and they are geared, in the case of hot-coke conveyors, to give a speed of approximately 55 ft. per minute.

The form of these sprocket wheels has been changed several times. Cast-steel teeth, made separately and bolted to the main casting, were first used; but such an arrangement was found to give trouble owing to the teeth working loose. Making the wheel in two halves—the cast steel teeth being made separately, supplied to the foundry, and incorporated in the wheel when it is cast—is found to be a more reliable practice. The latest method is to make the boss and major portion of the wheel in one piece of cast iron; the outer ring, of cast steel including the teeth, being made in two halves, attached to the main portion by bolts.

The hot-coke conveyors are in some cases situated well below the stage; but in more recent installations it has been usual to place them at, or just below, stage level. The first arrangement gives more comfortable conditions on the stage, but is not so convenient for repairs and regulating the quenching of the coke. Tray conveyors of the Babcock and Wilcox type are sometimes used for the elevation of the coke from the level of the retort-house stage to that from which it is distributed to the storage hoppers. The arrangement of inclined and hopper conveyors is decided by the relative position of retort-house and hoppers.

In some retort-houses the hot-coke conveyor chain is continued up the incline. This, in large retort-houses, results in a very long chain, but has certain advantages which I shall mention when speaking of the quenching of coke and the disposal of surplus water and breeze. A departure from this method of coke handling has been made in the case of a large horizontal retort-house recently reconstructed at Beckton. Here the coke, as soon as it is discharged from the retort, is conveyed by a transporter to the top of a coke-bench running the whole length of the house. It is quenched on this bench and falls into a telpher skip, in which it is elevated to a track which runs above the coke-hoppers. Breeze is removed by jigging screens fixed at the bottom of the hoppers before the coke is loaded.

Quenching Coke.

The problem of quenching the coke in the hot-coke conveyor sufficiently to avoid the risk of fires in the hoppers and at the same time leave a minimum of moisture in the coke is one of some difficulty. Coke is not discharged into the conveyor at a uniform rate; and if water is applied at a constant rate at several points, there is a likelihood that some portions of the coke will be insufficiently quenched while others may be excessively wet. This difficulty may to some extent be obviated by the use of automatic sprays. The coke, as it passes along, comes into contact with some form of plate or trigger, which opens a valve controlling a spray a little way ahead. Such an arrangement is, however, difficult to apply with the conveyor at stage level and machines on both sides of the house. In certain retort-houses at Beckton the control of a group of the sprays has been brought to one point; a separate service being run to each.

A good method of quenching coke may be employed where the chain continues up the inclined conveyor. In such cases the trough may be lowered a short distance—say, 4 in. in 20 ft.—just before the inclined portion begins. The sides of the trough are built-up to form a bath. It will be found that the quantity of water required is considerably diminished, and with care the coke can be uniformly quenched.

Disposal of Surplus Water and Breeze.

Another matter which presents a difficulty is the disposal of surplus water after quenching, and breeze. A certain excess of water is carried forward by the coke in the trough of the hot-coke conveyor. As the coke on the inclined conveyor is often subjected here to a final quenching, water also runs back from this point to the place at which the hot-coke conveyor discharges. This water and breeze may be led to some form of tank or pit in which the water is run off; the breeze having to be removed at frequent intervals.

In several retort-houses the whole of the breeze and water from the hot coke and inclined conveyors is now led into a large pit outside. The water, after being separated from the breeze, is in some cases re-pumped for quenching. The breeze is removed (say) once a day by a crane and grab. From the foregoing remarks it will be seen that part of the coke-handling plant is subjected to very severe conditions which make any attempts to lessen wear by lubrication useless. The use of oil-gas tar for the path of the chain not exposed to hot coke and water has been found advantageous.

Feeding Water-Gas Plants.

In many gas-works a fairly large proportion of the coke made is used in the carburetted water-gas plant, and the removal of this coke from the retort-houses or hoppers forms a considerable item in the cost of operating such plant. While in modern works the relative position of retort-houses and water-gas plant may, in the first case, be arranged to reduce such costs to a minimum, the site of the plant in older works is often rather remote from the retort-houses, necessitating the removal of the coke in trucks, which have to be elevated in a lift or tipped into a telpher skip before the water-gas operating stage is reached.

Mr. Gill, in his interesting lecture to this Association given at our opening meeting, remarked that iron seemed an unsuitable material for handling coke, and referred to the frequent use in America of band conveyors for the purpose. This form of conveyor is, I believe, rarely used in gas-works for handling coke in this country.

If breakdowns on the type of plant I have described are to be reduced to a minimum, considerable care is required in the maintenance of all chains and machinery installed. Chains should be frequently inspected in order that defective links, rivets, &c., may be replaced. Care should be taken immediately to quench hot coke lying in the conveyor in case of stoppages.

Driving Power.

The method of producing and the application of power for driving the plant would alone form an interesting subject for a paper of this kind. The use of gas-engines for this work is now giving place to electric motors; one motor being used for each separate conveyor chain. Apart from the benefit derived from simplifying the drive, and its application at the point at which it can best do its work, the use of an electric drive has the advantage that motors will usually "cut out" in case of abnormal load due to chain failure, and thus prevent further damage.

Conveyors of the tray or gravity bucket type and telpher plants have the advantage that they carry, rather than drag, the coke, and thus should not form so much breeze.

For some interesting comparisons between different types of coke-handling plant, I would refer you to Mr. Alwyne Meade's paper on "Gas-Works Construction and Practice," read before the Institution of Civil Engineers in 1918, together with the discussion and correspondence.

The installation of coke-handling plants, particularly those including the use of conveyors and hoppers, results in a certain increase in the amount of breeze made. In addition, the capital and wear-and-tear charges are high; and there is the possibility of occasional irregularities in carbonizing results due to breakdowns.

The use of such plant does, however, reduce to a minimum the labour charges in taking the coke from the retort-house, and the hoppers provide a very rapid and simple method of loading coke, particularly into railway wagons and barges.

The position or construction of a retort-house, especially when ground space is limited, often renders such plant almost a necessity. Apart from such considerations, it appears to me desirable that such unpleasant and arduous work as is involved in quenching and handling coke, in coke-holds sometimes originally designed to deal with smaller throughputs than are now obtained, should, if possible, be avoided.

DISCUSSION.

The PRESIDENT (Mr. F. A. Frost) said the labour of quenching and removing coke from some types of retort-houses was of a very arduous character—probably the most arduous of any in a works. The operation was therefore one which called for the introduction of mechanical arrangements wherever it was possible to instal them, apart from considerations of economy. The amount of wear and tear upon coke conveyors was still great. It was always important to bear in mind in this connection that the water used for quenching became acidified to a slight degree in the process, which rendered it extremely destructive to iron and steel. The author mentioned that in some cases the water was conserved, and used over and over again. He (the speaker) did not know whether this was altogether advisable. Had Mr. Lacey any knowledge of further concentration of acidity from this? Apart from its effect on the conveyor itself, there was the pumping machinery and the pipeline to be considered. The weaker the acid, the more destructive it was to iron and steel. This might seem rather strange; but nevertheless it was the case. Did the author think that the greatest amount of wear and tear arose from the abrasive qualities of the coke itself, or from the acidulated water attacking the various parts? Allusion was made in the paper to the American band type of conveyor, which seemed to be a very sound proposition. Probably some acid and heat resisting materials could be incorporated in the rubber for the band itself, and even in some other parts of the plant, so as to reduce the general wear and tear on the conveyor, and thus render it a better combination than the cast iron and steel installations that were in use at the present time.

Mr. D. C. CROSS (Lea Bridge) said they would all be agreed that a coke conveyor was very necessary for a large works; but in the case of smaller works there was a stage at which the maintenance cost was so great that it really paid to man-handle the coke. What was the smallest sized retort-house in which the author considered that a coke-conveyor would pay? Personally, his opinion was that with under twelve beds it would not pay to have a conveyor. At Lea Bridge they handled coke by telpher skip. Of course, they had the advantage there of vertical retorts. The coke was dropped straight on to the telpher skip, pushed-out on a trolley, picked-up by the telpher, and taken to the water-gas plant without further handling. Lea Bridge was notorious for the small amount of breeze available for use under the boilers. By careful checking, he had ascertained that the proportion of breeze they got out of their coke was only 10½ p.ct. At the water-gas plant, the coke was screened; and they took out on an average 15 p.ct. This allowed a little extra for the breaking of the coke as it dropped into the water-gas hopper. One of the difficulties of the skip arrangement was the quenching. Any amount of water could be poured on; and then possibly the core would not get quenched. He agreed that for a conveyor one could not beat the electric drive, which was certainly more handy on a gas-works than a gas-engine, because one could have a separate motor for each length of chain. The band conveyor was not much employed in England, as it could only be used with cold coke, and most of the conveying in this country was done with hot coke. Where cold coke could be handled, the band was about the best form of conveyor that could be obtained.

The PRESIDENT remarked that he thought Mr. G. M. Gill had told them that the hot coke travelled along without any difficulty.

Mr. LACEY said that, so far as re-circulating water for quenching was concerned, he could not tell them anything about the increase in acidity. He did not think it likely that the effect on the wear and tear of the chains or the plant was comparable in any way with the abrasive action. With reference to band conveyors, he had not intended to imply that they could be used for hot coke as discharged from the retorts. He believed Mr. Gill mentioned that in several cases he saw pieces of red-hot coke on the conveyor, which he (the speaker) took it were there by accident; and Mr. Gill was very surprised that the wear and tear figures were so low. As to the inquiry with regard to the smallest sized plant in connection with which one was justified in installing coke-handling machinery, this depended very much upon local conditions; and, of course, vertical retorts were rather a special case. On the whole, he should feel inclined to say that in houses carbonizing less than 150 or 200 tons a day, it was an open question whether such plant would pay. He agreed with Mr. Cross that, where a telpher skip was dropped into a bath of water to quench the coke, difficulty was liable to arise. Personally, he had had no experience; but he was told there was great trouble in quenching thoroughly, and that one was just as likely to get a fire as with the ordinary type of plant. The wear and tear of telpher skips in which the red-hot coke was pushed was, he believed, very high,

Mr. F. J. PEARCE (North Middlesex Gas Company) said that before he came to London he was at a works where they had the De Brouwer

type of conveyor; and it was found eminently satisfactory. The wear and tear on the chains, and also the bottom plates of the troughs, was not excessive; and, generally speaking, these conveyors were a paying proposition. The breakdowns were very few; and of all the conveyors, the De Brouwer was, to his mind, the best type. The author had not said much about telphers. While he (the speaker) did not suggest that the telpher was the best form of coke-handling plant for a very large retort-house, for a small works it was a very convenient and economical way of handling coke. They used a telpher at Mill Hill, and found it worked very well. The wear and tear was small. As a matter of fact, the first lot of skips supplied with the machine lasted about seven years; so there was not much to complain about in this respect. It did depend, however, upon how long the hot coke was left lying in the skips. When quenching, care had to be taken; and his Company made a point of insisting that the stokers should well spray the coke and douse it with water in the retort-house. When the skips were dipped in the tank, the result depended very largely upon whether the telpher driver allowed himself sufficient time properly to quench the coke. When he did so, there was very little risk of fire. It was quite a general thing now to drive conveyors and elevators, and all sorts of retort-house machinery, by electricity; and it was exceedingly convenient and economical. But electricity for the motors was usually generated at the gas-works; and if it was not generated by gas-engines it was by steam-engines, the steam for which was produced by breeze under the boilers.

Mr. W. GROGONO (Gas Light and Coke Company) also thought the De Brouwer the very best type of conveyor. He believed they were coming to the days when they would run the chain, not in a steel trough, but in a ferro-concrete trough, with cast-iron bottom plates, which could be easily taken out and renewed. The speed the author mentioned for the conveyor was all right if the charge had to be about 10 cwt.; but suppose it was a ton. To push such a charge out on to the sized track named would mean trouble. As to the question of telphers, he had in mind a house carbonizing 550 to 600 tons a day, which was being run by one telpher. The coke was quenched on a bench, and taken off the bench into a telpher skip and carried to the hopper. One man drove the telpher; and there was one man quenching, and one loading skips. The labour with this was very much heavier than on the De Brouwer type, which was looked after by one man; but there were some advantages. There were not going to be hopper fires; and the percentage of breeze was probably a good deal lower. The question of sprays was very important. With De Brouwer chains, the automatic spray to which the author referred was, he (Mr. Grogono) thought, obsolete. The breeze pits alluded to in the paper were about 30 ft. long and 26 ft. deep, and cost a fair amount to build; but the labour saving was wonderful. The whole of the water and breeze fell into the pit. A crane went once a day only, and removed the breeze.

Mr. LACEY said that with regard to the size and speed of the conveyor, he was only trying to give an approximate figure for most of the conveyors in the Gas Light and Coke Company. The difficulty with large charges could be got over by increasing the speed of the conveyor. As to control of sprays, if the house was large enough one could afford to have a man for the work; but in the case of a small house, a man for that purpose would hardly be justified.

Mr. GROGONO: It is not an extra man. It is the coke conveyor man who does all the quenching.

Mr. LACEY, replying to Mr. J. H. Goldsmith as to the use of oil-gas tar as a lubricant, said this was a commodity which they could not always dispose of as readily as they would like. It had not got all the properties as a lubricant that might be desired; but it had been found of use for particular parts of conveyors.

Mr. J. HEWETT (South Metropolitan Gas Company) said that the concluding words of the paper contained really the pith of the subject. They were: "Apart from such considerations, it appears to me desirable that such unpleasant and arduous work as that involved in quenching and handling coke, in cokeholds sometimes originally designed to deal with smaller throughputs than are now obtained, should, if possible, be avoided." The use of a conveyor was generally coupled with that of a screen; and therefore there was very little doubt that the coke produced for sale was of a far better quality than that which had to be loaded-up in the old-fashioned cokeholds under the house.

Mr. P. L. W. WOOLLEY (Gas Light and Coke Company) put questions with regard to the life of a chain, and whether it was advisable to turn it.

Mr. LACEY said the former point was very difficult to decide, because it almost invariably happened that a conveyor chain had several breakdowns during its life, and on each occasion certain portions were renewed and replaced. Conveyor chains had been known in this way to last for ever. [Laughter.] He would say that hot-coke conveyors should carry from 75,000 to 100,000 tons of coke and breeze in a lifetime. It was advisable to turn the chain at fairly frequent intervals.

ASCENSION PIPES.

By FRANK J. PEARCE, of the North Middlesex Gas Company.

[A Paper read before the London and Southern District Junior Gas Association.]

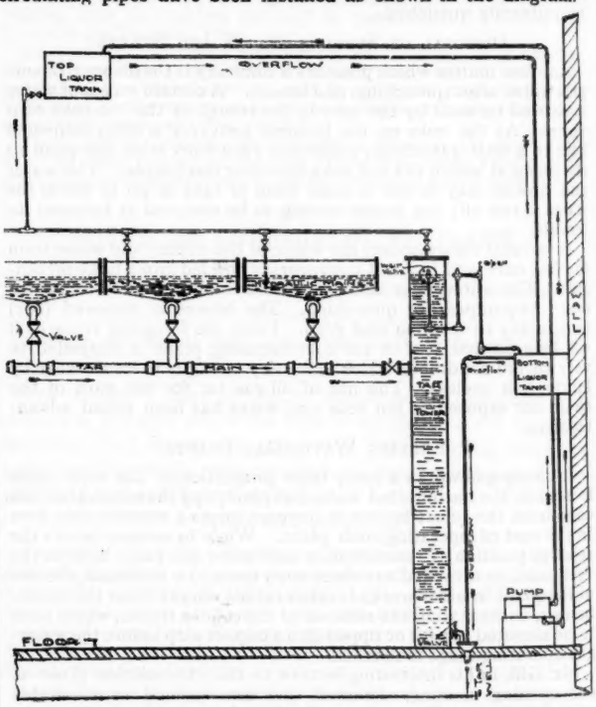
It would appear that the ascension pipe has always been a source of trouble to the gas engineer. From time to time various remedies have been proposed with a view to overcoming the nuisance of "stopped pipes," with the attendant loss of gas, &c.; while at the present time there are means employed by which the ascension pipe, as we know it, is dispensed with altogether. The author of a paper on this subject read before another Association a few weeks ago enumerated many of the causes of stopped pipes; but I am inclined to think that, when they are "boiled down," the explanation could, in most cases, be described very shortly—viz., "over-pulling."

It is not my intention in the short time at my disposal to enter into a lengthy discussion of the causes and possible remedies of the trouble, but to give you a few notes and observations on some work I have recently been carrying out in this direction, the results from which up to the present lead me to think the right course is being followed. For a long time past we have been very considerably troubled with stopped pipes; or perhaps it would be more correct to say we should have been had we allowed them to become stopped. It was only possible to prevent this by systematically "jumping" the pipes with a long auger from the top in addition to augering from the bottom; and it was necessary to employ an extra man to carry out this work.

When the coal strike occurred last spring, the Company continued making coal gas until the coal stocks were exhausted, when the whole of the coal-gas plant was shut-down and the supply maintained by carburetted water gas. This gave us the opportunity of very thoroughly overhauling the retort-house plant. One of the first things done was carefully to check the levels of the hydraulic mains; and it was found that they were not level—there being a decided dip towards the middle of the bench. This was rectified right through the house; so that when the mains were filled and the tar outlets opened-up from end to end of the house and into the towers, each dip-pipe had exactly the same amount of seal. In addition to this, the mouthpieces and doors were overhauled (the former being refaced if necessary), the retorts were crawled and patched, and all necessary general repairs effected.

The work of the retort-house is done by two gangs of stokers working eight-hour shifts—9.30 till 5.30; the draws being done at 10, 12, 2, and 4 o'clock. The only objection to this method I know of is the gap occurring between the 4 o'clock and the 10 o'clock draw, the result of which is shown on the recording calorimeter chart.

In order that there shall be a thorough circulation of liquor in the hydraulic mains and tar outlet mains, a pump and series of circulating pipes have been installed as shown in the diagram.



The same liquor is used over and over again, and the liquor made is utilized to take the place of the liquor employed in running-off the tar-towers, while the surplus runs down the overflow and away to the well. It has not been necessary to pump any fresh liquor into the top tank for very many weeks. The tar-towers are run-off daily, and in such a manner that the hydraulic mains never become "unsettled."

The manufacture of coal gas was recommenced about the middle of August; and the principal point to which I wish to draw your attention is that since that date it has not been necessary in the slightest degree to auger any pipe from the top. The only use at all made of an auger is before each draw, when the stokers open the doors and push an auger into the mouth of the pipe, in case there should be any slight obstruction.

After commencing work in the retort-house again, we experimented with various depths of seal and amounts of vacuum, until we finally settled-down to a bare ½-in. seal; it being found that with this seal, and the "pull" very carefully adjusted accordingly, the best results were obtained. The vacuum at the inlet of the exhauster is very carefully regulated by the engine-man, who has instructions posted to regulate his "pull" as follows:

7 a.m. or p.m.	− 2-10ths	12 noon or midnight	+ 1-10th
8 a.m. or p.m.	− 1-10th	2 p.m. or a.m.	+ 1-10th
9 a.m. or p.m.	− 1-10th	3 p.m. or a.m.	+ 1-10th
		4 p.m. or a.m	+ 1-10th]

At present the maximum pull is 10-10ths and the minimum 6-10ths; but this is varied according to the quality of the coal and the calorific value and specific gravity of the gas.

I should mention here that the exhauster pulls direct on to the foul main; the retort-house governor being bye-passed. By regulating the "pull" in this way, a certain amount of compensation is allowed over the gap which occurs between the 4 o'clock and 10 o'clock draws. A considerable drop in calorific power shows on the calorimeter chart. But on referring to the corresponding gravitometer chart, the drop is not indicated by any serious increase of specific gravity, and in fact is often not noticeable by any deviation of the line of record. These two recording instruments have been invaluable aids in obtaining the results I put before you to-night.

The question naturally arises as to what is the effect of this method of working on the make of gas per ton of coal, quality, specific gravity, &c.; and I think the following table will indicate very clearly that neither make nor quality has suffered. The figures are the averages of the daily tests for the three completed months, and each set of tests was made on a sample of gas collected in a 10-c.ft. holder over a period of 10 to 12 hours.

Month.	Make per Ton. C.ft.	Calorific Value, B.Th.U. Gross.	Therms per Ton.	Specific Gravity.	CO_2 P.Ct.	O_2 P.Ct.	N_2 P.Ct.	Total Inerts. P.Ct.
September .	10,380	592	61·45	·456	2·37	0·21	7·10	9·68
October . .	11,220	567	63·62	·455	2·76	0·24	6·85	9·85
November .	11,190	571	63·89	·447	2·81	0·23	7·80	10·84
Average for 3 months.	10,970	577	63·30	·453	2·64	0·23	7·25	10·12

The calorific values given are for washed gas. If, therefore, the average calorific value for the three months be taken—viz., 577—and (say) 3 p.ct. added to cover the extraction of benzole, this will then come out at 594 B.Th.U.; or the total therms per ton will be 65·16.

The coal used during the period under review was largely unscreened South Yorkshire, much of which contained an abnormal quantity of inert matter. I would also draw your attention to the inerts in the gas, as this is a point upon which a very close observation is kept. The average total for the three months amounts to 10·12 p.ct.

The method adopted to keep a check on these is as follows: A test cock is fitted in the gas take-off on each hydraulic main. The chemist and an assistant, each provided with a number of sampling cylinders fitted in a wooden frame, take a series of samples on each side of the house simultaneously, commencing at No. 1 bed. As these samples can be taken very rapidly, the time which elapses between the taking of the first and last is comparatively short; so that it can be assumed that they are all taken at the same time and under the same conditions. The samples are then taken to the laboratory and tested off for percentage of CO_2, O_2, and N_2. By this method any bed which shows an excess of either of these gases can be detected, and the source of the trouble sought and dealt with.

From the above table of results it will be seen that, with the quality of coal at present being used, and following the method of working I have described, the make has now settled-down to 11,000 to 11,500 c.ft. of gas per ton of about 590 B.Th.U. gross calorific value (unwashed); and I have no hesitation in saying that with an improvement in the quality of the coal, which we all desire, the results will be considerably better.

The immunity from stopped pipes is, I am convinced, due to the careful regulation of the seal in the hydraulic main in conjunction with the vacuum; the combination of the two being such that the ascension pipes are kept cool, thus preventing the tarry matter which adheres to the walls of the pipes becoming carbonized thereon and blocking the pipes.

The table given below may be of interest in this connection. The temperatures given are the averages of a series of readings I have had taken during the last few weeks, and I think fairly bear out my remarks with regard to the coolness of the pipes. The thermometers were placed in the bridge pipes, and the readings taken each hour. All the retorts except the top ones have single pipes; but I think a perusal of these temperatures points very definitely to the advantage of having two pipes on each retort, as it will be seen that the average temperatures of the top ascension pipes are considerably below those of the others.

Retort.	Time Charged.	Hours after Charging.											
		1	2	3	4	5	6	7	8	9	10	11	12
	a.m. and p.m.	Temperatures °Fahr.											
Top charging side. .	4	195	202	182	161	149	134	132	102	117	109	101	97
Top discharging side .	4	184	159	148	147	148	144	126	128	103	83	75	74
4 high	10	261	273	248	219	198	189	177	159	138	126	111	103
3 high	12	244	226	202	184	172	154	143	127	111	103	108	96
2 high	12	243	213	196	181	170	159	153	147	137	130	121	123
Bottom	2	224	219	207	202	191	181	181	179	156	139	129	135

I have not made any experiments with a view to determining the critical temperature at which the pipes will block. Possibly some of you may have information with regard to this, which would be exceedingly interesting.

There is one other point I should like to raise—viz., the material of which the pipes are made. The house was originally fitted-up with steel pipes, the great advantage of which is their lightness. I consider, however, that the list of advantages begins and ends there. If constant augering has to be resorted to, they wear-out very quickly—rubbing into holes or splitting; and if they have to be burnt out, they very easily go badly out of shape. There also appears to be a distinct tendency for any liquor which may condense in the upper portion of the pipe and run down to set-up corrosion in the mouth of the pipe or bend. As regards liability to block, I think there is very little, if any, difference between steel and cast iron; and as the steel pipes wear out, they are gradually being replaced with cast iron.

DISCUSSION.

The PRESIDENT (Mr. Frederick A. Frost) said that with the advent of the mass charge, stopped ascension pipe troubles, where this system was in operation, had practically ceased. After perusing a number of reasons given for stopped-pipe troubles, the author summed-up the explanation as being, in most cases, over-pulling. He was not going to disagree in any way with this verdict; but he would prefer to add a rider, and to say over-pulling was the trouble, and it was accentuated by the leaky condition of the retort itself. They could hardly attain to an absolutely bottle-tight condition; but the nearer they could approach to it, the less they would hear of stopped-pipe troubles. The drawing-in of furnace gases had the effect of raising the temperature of the gas passing up the pipe. It was by far the best method so to order the plant as to have the pressure inside the retort and outside in a state of equilibrium. The precautions Mr. Pearce had indicated would be of assistance to them. The temperature figures quoted by the author were much higher than he (the speaker) had experienced.

Mr. D. C. CROSS (Lea Bridge) said the only thing he had to criticize was the 594 B.Th.U. gas. He thought this was a gas of the past. Surely it was not economical. One was only getting 65 therms per ton; whereas by putting the quality a little lower, it was possible to get over 70 therms. Those of them who had been on a works for some time, knew that if they worked with gas up to 600 B.Th.U., it was pretty easy to keep away from stopped pipes. The trouble came more when they got down to 500 B.Th.U.; but these troubles, he agreed, could be nullified. At Lea Bridge, practically the whole of their troubles with stopped pipes had ceased. He did not approve of bye-passing the retort-house governor. They could easily put a small weight on it when they opened the doors. His Company were making 510 B.Th.U. gas, and their inerts were down to 9 p.ct. The author's temperatures in the ascension pipe were very interesting; but, like the President, his figures were totally different from these. Instead of a fall as the charge proceeded, he (the speaker) got a rather higher figure.

The PRESIDENT said he had always experienced the maximum temperature early in the charge; and with a rise towards the end, one would expect that furnace gases were getting in.

Mr. PEARCE agreed that the rise in temperature as the charge became spent was a plain intimation that furnace gases were getting in. At his works they had cut-out the retort-house governor for the simple reason that they worked better without it.

Mr. W. GROGONO (Gas Light and Coke Company) asked whether Mr. Pearce could give them the percentages of free and fixed ammonia in the liquor that was being circulated. Was the liquor being heated any further by exhaust steam? He noticed that the author tried his pipes every time the doors were opened. His own Company used to do this; but they got stopped pipes at the bottom, by bad trying. Their pipes were now only tried once in every 24 hours; and stopped pipes had ceased. Could Mr. Pearce give figures of his inerts after the purifiers, before blue water gas or oil gas was added?

Mr. PEARCE remarked that it was really not quite correct to say the same liquor was used over and over again, because there was always a certain amount of liquor being made. The liquor contained 63 p.ct. of fixed ammonia, and 37 p.ct. free. As regarded the temperature of the liquor, they did not adopt any auxiliary means of heating. The only heating it got was due to circulation in the hydraulic mains. He had seen stokers try the pipes at the bottom time after time; and in no single instance had he seen a really blocked pipe. As to the figures for inerts, those tests were all made on purified straight coal gas before any admixture with water gas.

Mr. P. L. W. WOOLLEY (Gas Light and Coke Company) referred to the cutting-out of the retort-house governor, and asked what method would be adopted in the case of more than one retort-house.

Mr. PEARCE replied that if there was more than one retort-house, they would of necessity be compelled to use the retort-house governor, because it would be almost impossible to get the same conditions in all the houses.

Mr. T. V. JOHNS (Richmond) asked whether they tried to keep the inerts low at Mill Hill, because, if so, he did not see that it was an advantage. Did they find it cheaper to make a rich coal gas such as they were making, and reduce this down by the water gas?

Mr. PEARCE said that perhaps he ought to tell them they were sending out 70 p.ct. of water gas. As far as they had gone up to the present, they found it undoubtedly best to make a rich coal gas, and do away with all the trouble of stopped pipes. He did not say that they would always keep at 594 B.Th.U., as they had not yet done with the experiment, and he was anxious to see how far they could get it down without unduly raising the inerts.

Several other questions were asked by members, and answered by the author.

Following upon the death of Mr. William Thomson, we understand that the Ramsgate Gas and Water Committee have given authority to Mr. M'Vean (Assistant Engineer) and Mr. F. G. Sale (Mr. Thomson's Secretary) to carry on for the present.

MIDLAND JUNIOR GAS ASSOCIATION.

At a Meeting of the Midland Junior Gas Association, last Thursday, at the Council House, Birmingham—Mr. C. F. W. RENDLE presiding—Dr. E. W. Smith (London) read a paper on

INDUSTRIAL GAS AND INDUSTRIAL FURNACES.

I hope I shall be pardoned to-night if I venture to wander a little in the realms of the politics of industrial town's gas before touching on the subject of industrial furnaces. Now that gas undertakings are at liberty to supply the grade of gas that will best suit each community's requirements, there should be an increasing tendency to give fuller consideration to the more careful study of the requirements of the consumer, because only by so doing can gas outputs be increased and gas-producing plants worked at their highest efficiency. It must be conceded that the subject is not an easy one. The consumer requires cheap therms. He must be able to rely on an adequate and constant pressure of gas; and the quality—whether it be composition or calorific value—should be such as to enable him to meet the demands of most heating operations.

Let me for a moment draw your attention to some of the difficulties that exist, and in doing so we shall be carried a little way towards their solution. Is there any general consensus of opinion as to the cheapest method of producing therms in the form of gas for any given set of fixed conditions? It is obvious that each gas undertaking has its own peculiar set of conditions. The delivered cost of coal, the value of coke and residuals, and the capital value and condition of already existing plant—whether for production or distribution—are all factors that, among many others, vary so greatly from works to works that it would be foolish on the part of any one to try to lay down any fixed and detailed conditions for the cheapest production of therms.

I believe it is unfortunate for many undertakings that there is not a keener competition such as exists in the production and sale of most marketable and manufactured goods available in the open market. There is no doubt that the large majority of gas undertakings are desirous of supplying the requirements of the consumer in the best possible way; but until business is actually lost, I am afraid that all that could be done is often not done, and such a method is so disjointed that its effect is frequently to give but a temporary alleviation of present difficulties. This is certainly not discouraged by the fact that the conditions of gas supply are monopolistic. The consumer is faced with all kinds of difficulties if he wishes to change-over from one fuel to another. He must take the gas available or leave it. He cannot get any better or worse from any other source unless he makes his own; and it would seem a pity for him to have to consider it. He can certainly turn over to coal, coke, oil, or electricity, depending on the particular requirements of the consumer. Only in the latter case can he feel there is any likelihood of a greater constancy in service; and he knows that it will cost him more. Now whatever the cost of gas to the consumer, the first requirement is constancy of supply, constant pressures, and constant composition within all reasonable working limits. Once gas has been installed, the gas undertaking is in honour bound to give the best possible service—one such as would be given if it were in close competition with another gas supply that could be tapped at will and used on the consumer's plant.

I should not like to be misunderstood in my discussion of this subject. My desire is to review the position, find the dangers, try to understand the possibilities of danger, and so assist further in building up a healthy, vigorous, well-informed national industry existing to supply a national want of supreme importance on monopolistic lines. I believe that the spur of competition in the industrial field is not yet sufficiently strong, and that as soon as it is generally realized that there are tremendous possibilities in this field the competition will commence, and the problem of the cheap production of therms in a gaseous state will be more fully studied.

In recent years there have been a number of advocates for the reduction of gas calorific values down to very low figures. It has been stated that for most purposes these gases, where burnt in suitable apparatus, give at least as good results as gas of a much higher calorific value, B.Th.U. for B.Th.U; and this has been confirmed by the Gas Investigation Committee's researches. So far we have not seen any results, over a reasonable period, on comparative lines, that prove, in general, that the cost of production at works of British thermal units of low calorific value, is less than of those of high calorific value; and no one should object to the statement that the cost of distribution will go up as the calorific value goes down. There is no doubt that very moderate steaming in verticals reduces the cost on works to a greater extent than the distribution costs are increased owing to the reduced calorific value.

One hears of gas engineers who have reduced their calorific values radically, and claim that they have given satisfaction to the consumer and have at the same time experienced no distribution troubles. To what extent does this really hold? In the large majority of industrial plants, a reduction in calorific value must mean an increased consumption of industrial gas corresponding at least to the reduced calorific value. Are these therms being produced at a lower cost than if a higher calorific value gas were made? And how much more is gas costing to distribute—or to what extent is the capacity for therms of the distributory system being reduced? I have a feeling that there are many instances where calorific values below 500 gross have been adopted too precipitately. It has certainly paid temporarily to be able to sell 14,000 to 15,000 c.ft. to the ton as against 10,000 to 12,000 c.ft., regardless of quality; but under the new scheme British thermal units only will be paid for, however concentrated and however diluted.

In many cases it pays to dilute with blue water gas; but an economic balance, special to each concern, has to be struck before one can decide just what percentage of blue water gas to make; and unless undertakings are supplied with adequate mixing arrangements, trouble may frequently arise through patches of unmixed gases getting on the town.

I believe that in a great many cases complaints of bad gas arise from inadequate pressures. To what extent is this due to lower calorific values or higher specific gravities?

The consumer's own meters and services are often not large enough to pass lower calorific value gas, and the cost of alterations has not in recent months been justified by the reduced cost of the lower calorific value gas. In two or three years' time one would expect that the knowledge, and more particularly the experience, gained in these matters will be sufficient to assist one to come to more definite conclusions. In the meantime, my advice is "Move warily! Hesitate before making any reduction in the declared calorific value from coal gas below 475, and do not drop even to this figure unless there is ample evidence to justify it."

INDUSTRIAL GAS SALES.

In all gas undertakings there should be three sides—(1) Production, (2) Distribution, (3) Selling. Of these three I am convinced that the last, the selling side, is by no means the least important. It is the department that comes in contact with the consumer. The other two are solely of internal significance; their only business being to "deliver the goods." To "sell the goods" has been no easy matter in recent years. In most cases necessity has done the selling. During the war we might have been prepared to eat black bread, even at a high price, if no other food had been available; but we would not retain its use longer than absolutely necessary. Now we are returning to more open competition, and much of the success of gas undertakings will depend on the gas sales side. In ordinary industrial enterprises the greatest commercial success comes when the demand can be kept in advance of supply. In close competition the selling side creates the demand. In this way, all plant and labour are kept fully occupied and worked to the highest efficiency. Sir Gordon Selfridge has stated that in all successful businesses it costs more to sell an article than to make it. This need never be the case in the gas industry; but there is no doubt that a great deal more should be done on the selling side. Very little has so far been done in particular in connection with the selling side of industrial gas. A few of the larger concerns have tackled the subject in an excellent way; but it must be recognized that it demands a very different type from the domestic heating and lighting salesman.

In most industrial towns industrial gas should be the mainstay of the gas undertaking. In the main it is a day load; it is fairly constant, winter and summer; and it is relatively a big load per consumer. The costs per therm for installation and service charges are less than for the domestic consumer; and this has been recognized by most undertakings through reduced charges. Has sufficient been done, however, to encourage this load? Is it not worth much more than is represented by the differences in gas-rates that have usually ruled? On the other hand, if the industrial consumer can take large or small supplies of gas at will, the gas undertaking must always be in a position to deliver the maximum demand. It is not, in my view, good business to include in the charges per 1000 c.ft. for industrial gas any amount to cover charges for stand-by plant. It would be very much better to make a simple contract with the larger consumer in which the undertaking guarantees to supply a given daily maximum and the consumer guarantees to take a given daily minimum. Should this latter quantity not be taken, he will pay according to an agreed scale on all gas that falls short of this minimum in order to pay for plant standing idle. The same end is not achieved if the price per 1000 c.ft. is reduced gradually with increased quarterly consumption, although this latter system is an excellent one for encouraging increased industrial sales. As, however, the highest price is never higher than the top domestic rate, the method is not sufficient to cover the cost of idle plant brought about by the sudden stoppage in industrial furnaces.

This matter is a subject of serious study by a Sub-Committee of the American Gas Association dealing with "Industrial Fuel Sales Contracts." This Sub-Committee have recently reported to the Association; and while coming to the conclusion that a standard form of industrial contract is not feasible, they were prepared to make concrete suggestions and recommendations looking towards the standardization of general practice regarding the sale of gas for industrial purposes.

The Committee make the following recommendations:

(1) That the rules and regulations of all gas companies should cover alike gas used for industrial as well as domestic purposes.

(2) That all gas companies adopt a schedule of rates for large commercial and industrial users that will enable the customer to earn a reasonable rate and the gas company a fair profit, and that this schedule should carry any special rules applying specifically thereto which cannot be incorporated in regular rules and regulations.

(3) That all gas companies adopt a form of application for gas service suitable for such commercial and industrial customers who desire to avail themselves of the schedule of rates applicable to such users, which application, when accepted by the gas company, to constitute a contract to remain in force for a given period.

(4) It is further recommended that the work of this or a similar Committee be continued during the coming year for the purpose of drawing-up and submitting specific forms of applications or contracts applicable to the several types of existing rate schedules, which may be used in an effort to standardize practice regarding the sale of gas for industrial purposes.

I am quite sure that a similar inquiry would serve a very useful purpose in Great Britain. It would be a pooling of considered experience on a very important subject, and many undertakings would be benefited thereby.

The Peculiar Position in the Gas Industry.

If anyone were to ask what constitutes the gas industry, the reply would fall far short of fact if it were restricted to "the gas undertakings." It would be more correct to say:

(1) The gas undertakings.
(2) The companies which build the various kinds of plant for use in the gas undertakings, and
(3) The companies which manufacture plant and apparatus in which gas is used.

It would be difficult to determine which is the most important of these three; and it would be unnecessarily invidious to attempt to do so. All are interdependent in a successful industry. Each depends entirely on the increased use of gas by the consumer. The success of one of the three means increased business for the others, and the failure of one section seriously affects the others. Their interests are one and inseparable. Like ideals should imbue them all; and the more co-operation there is between them, the better will be the effect on the industry as a whole, and, more important still, on national prosperity. It will not be gainsaid that this co-operation is not so effective as it should be. Some of the members of one section consider themselves on a higher plane than the others—a professional plane, that debars any but formal and disjointed co-operation between the "elect" and the "trade." Please do not assume that I am cynical about this. It would be a matter rather for jest than anything else, but for the fact that the chief sufferer for this state of things is the industry as a whole, and through it, the nation's trade. All three should combine together to increase the use of industrial gas. Each has its own responsibilities in this matter; but little can be done while the relationship between the three is such that two of them often have metaphorically to go "cap in hand" to the third as traders to obtain the orders that are equally necessary to them all. Our competitors in the electrical industry do not suffer in this respect. With them the co-operation between the electrical trades and the electric supply is very much closer; and there is a corresponding benefit to their industry.

Increased industrial gas sales will be brought about (*a*) by reducing the selling price of gas, (*b*) by developing industrial furnaces that are not only thermally more efficient, but which have a greater over-all efficiency than furnaces using other fuels, and (*c*) by developing a well trained and specialized selling side for industrial gas.

The responsibility for (*a*) rests both with gas undertakings and with the plant manufacturers. The former by better organization and improved control of plant, and the latter by developing improved plants of lower capital costs per therm produced.

Under (*b*), at present the responsibility is in some few cases that of the gas undertaking, and in the main that of the furnace builder. As one more particularly interested in the latter, I feel a great deal remains to be done in successfully adopting town's gas to popular industrial use. I firmly believe that each gas undertaking should have a competent industrial sales engineer. He should be a highly trained, tactful engineer of wide experience in industrial heating problems of all kinds, whose main experiences should have been gained in other industries than the gas industry. I believe that it is the function of such a man to work closely in conjunction both with the consumer and the furnace builders, acting as an independent adviser to both. He loses this valuable function immediately his functions include that of furnace builder. The main object of all is to increase the sale of gas. If the gas undertaking has not an efficient load for the amount of plant it possesses, the price of the gas it does make will be higher than if a greater proportion of plant were working, and because of the increasing price more consumption is lost. Less new plant is required, the plant builder suffers, and the furnace builders feel the draught when furnaces are not called for.

Many undertakings in the past have adopted the policy of free fixing and permanent hire of gas-fires and gas-cookers at charges which could not produce a commercial profit on the transaction but for the increased sale of top-price gas brought about by the installation of this type of apparatus. The gas fire and cooker maker could afford to supply the apparatus to the gas undertakings at comparatively low prices owing to the large quantities of the same class of goods required. The same set of circumstances cannot hold in the furnace business. Where one standard type of furnace is required, there will be perhaps a thousand gas-fires or gas-cookers. Consequently, the cost of production of gas-furnaces is relatively high. It is doubtful whether any small furnace builder will ever make a commercial profit out of well-built small furnaces. Consequently, it will be found that small furnaces are made (1) either by the gas undertakings themselves (which is to be deprecated) at a comparatively low cost, having a low overhead, requiring little profit, and being on the spot, or (2) by companies, having large profitable businesses in other gas-making or consuming equipment, in order still further to encourage the use of gas and so reduce its cost of production.

In America, a number of gas companies have arrangements with individual furnace makers to act as industrial gas engineers for them in their areas of supply. The furnaces are installed at cost; and the furnace builder receives payment per 1000 c.ft. on the gas consumed in the furnaces over a limited period. I understand that this system works well, but obviously the arrangement could only be made with industrial furnace engineers of proved capacity and standing.

However the question of the industrial gas-selling side is handled, it is essential that all engaged in the design and construction of industrial furnaces should with renewed efforts concentrate on the production of better and cheaper furnaces. The chief essential in all industry is increased production per unit of labour and plant. Relatively too much stress has been laid on the importance of an increased production on the part of labour; and the possibilities of new organization of work and improved types of plant have been insufficiently explored. But only relatively is this so, as labour will have to realize—if unfortunately through dire necessity—that it must work in loyal co-operation with its co-partner in industry, the employer, by showing a keenness to develop a personal and lively interest in reducing costs and improving quality. This applies all round—in the gas industry as in all others.

But much can be done in improving plant and machinery. Gas-furnaces are used in a large variety of operations; but where speed of operation is important, flame temperature is the outstanding factor worthy of the closest study. One has heard a great deal in recent years of the importance of theoretical flame temperature in all heating processes, whether it be a high-temperature furnace, a gas-fire, or an incandescent mantle. How often is it not realized that the differences that are found in every-day practice between the methods of burning gas are such as to mar completely any advantages there may be in using a gas of high theoretical flame temperature! This has been shown to be the case in many instances where better results have been obtained by very low calorific value gas than with a much higher calorific value gas used in the same apparatus. This does not in any way diminish the fundamental value of high flame intensity; but one cannot help but agree that there should be endeavour to arrange deliberately, not by accident, to achieve in all heating operations the maximum temperature of combustion—that is, the maximum flame temperature from all gas that is burnt—if rapid heating and high efficiencies are desired.

The Process of Surface Combustion.

"Surface Combustion" is the term applied to the process long recognized as ideal for accelerating the oxidation of fuel gases. The name originated in England, where it was applied to the catalytic action of metals, such as platinum and silver, upon homogeneous explosive mixtures of air and combustible gases. At first the catalysis was studied at low temperatures below the ignition point of the mixture. It was observed that as the temperature of the metal was raised the reaction was accelerated in practically all cases.

Prof. Bone, in continuing his work on the subject, found that the speed of reaction was very much increased when the metal was raised to a temperature sufficiently high to emit light, and that at such temperatures non-metallic substances, such as firebrick, porcelain, &c., began to exert an accelerating influence, which increases with the increase in temperature of the solid. Whatever may be the influence of the solid at low temperatures, the influence of any solid in granular porous condition was found to be more and more nearly equal to that of any other as the temperature of the solids increased. It was soon confirmed that above ignition temperatures the effect of the influence of solids was so great that, when strongly incandescent, these gaseous reactions are accelerated to several million times greater than the ordinary rates of combustion.

Efforts were at once made to apply the discovery to heating practice. The work naturally led to the use of homogeneous mixtures which contained air and gas in quantitative proportions for complete combustion. Such mixtures are termed "perfect mixtures," and the reaction "perfect combustion." In these perfect mixtures the time required for reaction is what may be termed of molecular dimensions referring to the time interval between the collisions. P. Lenard, in the "Annalen der Physik," suggests that the projection of these perfect mixtures against large effective areas of incandescent solids subjects them to the ionizing influence of the ultraviolet or short wave-length light, and causes increased sensitiveness to molecular impact, and thus promotes greater speed of reaction. Under the conditions stated, combustion is flameless and invisible. In describing the process, Prof. Bone and his associates made use of the term "flameless incandescent surface combustion."

Prior to the work of Prof. Bone, Lucke employed granular refractory material to assist in combustion when using similar air-gas mixtures. He adopted the term "surface combustion," but in a different sense from that of our English workers. A supply of air-gas mixture issuing from an orifice at a rate of flow exceeding

the speed at which combustion is propagated through the mixture will expand, and the linear speed of all parts of the mixture will decrease. There will appear a zone at which the flow speed will equal that at which combustion is propagated. At the surface of this zone, Lucke conceived that combustion would begin, and that the reaction would be complete within a very short distance—hence the term used by him of "flame cap" or "surface of combustion." Owing to the difficulties experienced in regulation, a steady maintenance of the flame cap was found impossible, and use was made of granular refractory material as a baffle and container for the surface of combustion.

Although Lucke did not originate the term "surface combustion," nevertheless the Americans have developed "surface combustion" furnaces on successful commercial lines; while so far we in England have not seen any practical applications to industrial furnaces of the original surface combustion English patents. The small cyclone metal melting furnace of Thomas Fletcher, in general use many years ago, incorporated the idea of surface combustion. The English experimentalists appear to have concentrated on an attempt to combust gas either on the surface of refractory diaphragms, or in (rather than on) refractory beds of granular material.

PERFECT COMBUSTION.

"Perfect combustion" is the aim and attainment in the process that I propose to describe to you this evening; and the above term has become synonymous with "surface combustion." The furnaces that have been developed by the staff of the Surface Combustion Company in America, who own the American rights of the Bone and Lucke patents, are a proved commercial success. Last year I inspected between 40 and 50 of their 2600 installations in many of the largest industrial concerns in the States; and all the users were enthusiastic in their praise. In spite of the relatively low price of oil as compared with "city gas," they are displacing oil-fired furnaces right and left. On making a detailed inspection of these installations, it was immediately evident that they incorporated none of the subjects of the Bone patents. These furnaces depend for their success on six distinctive features as follows:

(1) An air-gas proportioning system.
(2) An air-gas mixing system.
(3) A suitably designed burner that cannot, during operation, light-back.
(4) The combustion of homogeneous perfect mixtures in an exceedingly small space on the surface of highly refractory material.
(5) The transmission of heat almost entirely by radiation from the refractory material which has been raised to maximum incandescence with the gas available.
(6) There is no flame contact with the material that is fed into the furnace.

Let us look into the details of these individual features. By means of the various air-gas proportioning devices it is possible, by simple one-valve manipulation, to vary over a very wide range the quantity of gas passing to the furnace burner without in any way altering the pre-arranged relationship between the air and the gas in the mixture. This can be done with low-pressure gas and air at no higher pressure than six "W.G.," or with high-pressure gas and injected air—the gas having a pressure no higher than 1 lb. The mixtures attainable are such that the waste gases can be made to contain either CO or oxygen at will; and until further adjustment be made, the percentage of either of these gases will remain constant within less than 1·0 p.ct. over large ranges of consumption. The following independent test was carried out by the Franklin Institute of Philadelphia to check-up this claim; and it will be seen that it is fully confirmed.

The differences in percentage of oxygen in mixture and theoretical oxygen required give approximately the percentage of excess O or the percentage of CO in the flue gas. As a result of their investigation of surface combustion installations, the Franklin Institute awarded the Edward Longstreth Medal of Merit for gas jet entraining apparatus to W. B. Eddison, who, as Chief Engineer of the Surface Combustion Company, of New York, designed and developed the surface combustion proportioning systems.

Gas used—mixed gas . . . . . = 533·5 B.Th.U.
Theoretical oxygen required in mixture . = 17·07 p.ct.
Theoretical carbon dioxide formed . . . = 16·2 p.ct.

Run No.	1	2	3	4	5	6
Gas pressure at orifice, lbs. per sq. in.	9·38	7·44	5·89	4·74	2·90	1·12
Mixture pressure at burner, in. of water	4·4	3·6	2·8	2·3	1·35	0·50
Rate of gas consumption, c.ft. per hour	481·0	438·0	375·0	333·0	254·0	164·0
Percentage of rate at first run .	100·0	91·0	77·9	69·2	53·0	34·0
Percentage of oxygen in mixture	17·10	17·00	17·05	16·97	16·88	16·86
Percentage of required theoretical oxygen	100·17	99·59	99·88	99·41	98·88	98·77

The apparent temperature in the furnaces varied from 2550° Fahr. (1400° C.) after run No. 1, to 2250° Fahr. (1230° C.) after run No. 6.

The true temperature was somewhat higher, as soft iron wire melted quite readily during No. 1.

The carbon dioxide with the furnace top open equalled 14·8 to 15·2 p.ct. With the furnace top closed it equalled 16·1 p.ct.

The importance of this means of automatic control of mixtures will be recognized when it is remembered that a fundamental desideratum of this system is the attainment of maximum flame temperatures. To do this it is essential that perfect mixtures only shall be combusted. Any excess of air or gas will inevitably reduce the flame temperature, and the heat lost in the waste gases will be increased. Normally in furnace practice it is held that complete combustion can only be attained in the presence of an excess of air; and, as a consequence, flame temperatures are reduced and waste-gas losses are increased.

The following table shows the effect of excess air on waste-gas losses at different temperatures:

P.Ct. Heat Loss.	20 P.Ct. Air, 13·2 P.Ct. CO_2.	50 P.Ct. Air, 10·5 P.Ct. CO_2.	75 P.Ct. Air, 9·0 P.Ct. CO_2.	100 P.Ct. Air, 8 P.Ct. CO_2.
At 3000° Fahr. . .	11·5	29·0	43·5	58·0
,, 2000° ,, . .	7·0	17·5	26·5	35·0
,, 1000° ,, . .	3·0	7·5	11·3	15·0

The theoretical CO_2 content on the quality of gas used would have been 16·0 p.ct. when combusting a perfect mixture.

Elaborate tests have been carried out to determine the effect on gas consumption by allowing varying percentages of excess air when desiring to maintain certain fixed temperatures in a given furnace. These are shown in the following table compared with the gas consumption when using perfect mixtures.

—	2500° Fahr.	2200° Fahr.	2000° Fahr.	1850° Fahr.	1460° Fahr.
0 . . .	165	120	95	70	45
20 . . .	200	127	100	74	48
40 . . .	300	150	107	77	53
60 . . .	700	245	120	90	57
80 . . .	Not attained	355	145	107	63

GAS CONSUMPTIONS, CUBIC FEET PER HOUR.

It will be noted that when only low temperatures are required, such as 1460° Fahr., the flame temperature is sufficiently high, even with some excess air, to obviate the necessity of as great an increase in gas consumption as when the difference between flame temperature and the desired furnace temperature is very small.

In many industrial operations it has been impossible satisfactorily to handle materials in the open-oven type of furnace, owing to the presence of flame and to the effect of free oxygen. This is completely obviated in the system where the process is flameless and the atmosphere is completely under control. In this way, more efficient heating is possible, outputs are increased, and oxidation, and consequent spoils, are eliminated—and all by means of one-valve control.

The second feature of importance is the means provided for efficiently mixing the air and gas after the correct proportions have been obtained. Too little attention has been paid to this in the past. Few burners are sufficiently good mixers, and, as a consequence, delayed combustion of the gas results in more or less lengthy flames, even though the proportions of air and gas are correct. The mixture should burn in the open as a ball of flame. If interfered with by refractory materials, it will burn on the surface of these materials apparently flameless. In this way maximum temperatures are produced.

The proportioner and mixer are so designed that, with but moderate pressures of air or gas as the injecting fluid, it is possible to inspirate more than sufficient of the other fluid and maintain mixture pressures along the piping connecting them to one or more burners much higher than have previously been demonstrated. This is important from the point of view of good distribution to the burners; but it is absolutely essential at the burners, from which the velocity of the mixture shall be such as to bring about combustion on the refractory material and not at the burners.

The third feature is the burner. This consists of an easily adaptable, comparatively large casting having a relatively small outlet; the edge of this being the only part exposed to the radiations from the furnace. The heat absorbed at this point is quickly and adequately carried away by the bulky casting and radiated to the external atmosphere. The burner is packed tight into the brickwork of the furnace, and is protected at the tip by means of a highly refractory cement.

The mixture pressures in these burners are such that the velocity of the gases leaving the burners is sufficient to carry the mixtures on to the refractory material prior to their combustion. In this way all the conditions are perfect for the production of the highest attainable temperatures on the refractory material in the absence of recuperation; and, consequently, not only is the maximum amount of radiation attained, but the products, being of minimum volume per unit of heat, are at their maximum temperature, and have a maximum heating effect on the material in the furnace. Their rate of travel through the furnace is also at a minimum; and, in the absence of any delayed combustion through the elimination of flame, burning and oxidation are prevented.

Owing to the surface combustion principle of heating bringing about the elimination of combustion in the working part of the

open furnace, without the necessity of using a muffle, it will be seen that radiation plays a great part in attaining these results. Too little attention has been paid in the past to the value of radiant heating in furnace work, largely because the factors that go to the efficient production of radiant energy have not been worked-out. Surface combustion furnaces incorporate in their design the latest researches on the subject, and the results attainable are certain to make a strong appeal to all those who are vitally concerned in increasing the quality of materials treated, increasing the output of furnace units, and considerably reducing the labour and fuel costs per unit of material handled.

Only recently, in order to test the evenness of heating over the whole of the working hearth (24 in. by 15 in.) of an oven type of furnace, nests of three cones each were distributed evenly over the hearth, and the furnace lighted-up. The cones in each nest were Nos. 13, 14, and 15. The furnace was held at a temperature just short of No. 14 cone, and on examination of the cones after the furnace had been out some hours, it was found that all the No. 13 cones had been squatted, all the No. 14 cones showed similar signs of slight bending, and all the No. 15 cones were untouched by the heat. It will thus be seen that the whole of the furnace must have been extremely evenly heated, and without requiring any special effort or intelligence on the part of the operator.

Radiant heating makes evenness of heating easy of attainment, and efficient radiation depends on developing the maximum temperature of combustion. It will be seen from the following table that the heat transmitted by radiation increases very rapidly with the rise in temperature of the radiating surface. The figures are for black body radiations.

Radiating Temperatures. Fahr.		B.Th.U. Radiated per Hour per Square Foot.
1000°	..	6,000
1500°	..	18,000
2000°	..	60,000
2500°	..	120,000
3000°	..	225,000
3500°	..	395,000

During the war, the possibilities for even heating were fully employed by the United States Ordnance Department, at the Watertown Arsenal. Mr. Laurance T. Clark, of the editorial staff of the "American Gas Engineering Journal," states that when it was decided to build another gun plant in 1917 at the above arsenal, oil firing was favoured; but eventually gas and electricity were adopted, and "Surface Combustion" gas-furnaces were installed alongside electricity heated resistance furnaces. As a result, on quality of heating there was nothing to choose between the two; but while repairs to the gas-furnace were only a matter of minutes when accidents occurred with the guns, the electric furnaces would be shut-down for at least a week. The largest furnace was 37 ft. high and 9 ft. 6 in. in diameter. It was found that, whether hardening at 900° C. or drawing at about 620° C., the variation in any part of the working zone did not exceed 50° C., which was within the range of accuracy of the pyrometers used. It was the practice in the hardening operations to heat the gun-barrels at the rate of 100° to 150° C. per hour to the required temperature, to soak and hold for five hours, and to quench in water. The average time for this operation was ten hours, which meant twelve heats per week. The gas used over a week's run worked-out to an average of 2·84 c.ft. per pound of steel heated to an average temperature of 915° C. The largest single charge was 28,500 lbs.—a gun having a 288 mm. calibre. The highest temperature employed was 950° C. The gas was town's gas, of about 550 calorific value.

It will be gathered from this interesting account that the surface combustion principle is applicable to both large and small types of furnaces. This is also indicated by the extent to which it has been applied to large shipyard furnaces, which were so fully dealt with in a paper by Mr. G. Keillor, of Greenock, and delivered before the October meetings of the British Commercial Gas Association.*

I have endeavoured to describe the features which are distinctive to the new surface combustion equipment. It will be obvious that these improvements in furnace design cannot be obtained without cost. It is not claimed that on first cost surface combustion furnaces are cheap furnaces. It is claimed that wherever the principle is applicable the furnaces will more than pay for themselves over a comparatively short period. With them the over-all costs of industrial operations are reduced through lower fuel consumption, low maintenance charges, low supervision charges, increased output, the improved quality of materials treated, and freedom from rejects and spoils.

There may be some among you who would like me to give a mass of details and figures of cost and fuel consumptions in surface combustion furnaces for various operations. I am sure the industrial sales engineers among you will thoroughly appreciate my diffidence in doing so. They know how misleading such figures can be, and how valueless they really are. The conditions of working do vary so much that, unless they are stated in the greatest detail, they are not even comparatively useful. I therefore feel that it would be better not to put forward any general figures.

One of the most recent applications of town's gas for industrial heating in this country is in the galvanizing industry. The large steel tanks are nearly filled with zinc, and either sheet steel or pipes, &c., are passed through the metal to obtain a coat of zinc. It has been usual to heat these tanks with coke, and irregular heating has been the result. On fuel costs alone gas has proved as cheap as coke; but the chief advantages are on other grounds. In parallel tests that have been carried out, it was found that with a 12-ft. tank it was possible to obtain a throughput of 15 tons of castings in a ten-hour working when using gas; while the output with coke was only 10 tons. The dross formed, which is a direct loss and is found at the bottom of the tank, was 800 lbs. with gas against 1500 lbs. with coke. It can be taken as a rough guide that the capacity of the tank for zinc corresponds to the output of the castings in a ten-hour day.

It is usual to run a 12-ft. tank on 13,000 c.ft. of 580 B.Th.U. gas in the ten hours; the metal being maintained at 875° Fahr. For ten hours during the night the metal is held at a temperature of about 880° Fahr., with a total consumption of 8000 c.ft.; no castings or sheets going through the tank. For two periods of two hours each the gas is turned-off. The efficiency of the furnace runs between 40 and 50 p.ct. when the galvanizing is carried on continuously over the twenty-four hours.

The small portable rivet heaters cannot claim to have a high thermal efficiency. They are made light for portability. Nevertheless, although having only a 26 p.ct. efficiency, their output is high; being 218 ¾-in. rivets per hour.

The circular rod-end forging furnaces, working at a temperature of 2400° Fahr., have an efficiency of 40 p.ct., with a flow space of 27 in. square floor space. The output is 800 ⅞-in. bars per hour, and the consumption 900 c.ft. of 500 B.Th.U. gas per hour.

In recent months the open-oven type of furnace has been found entirely satisfactory for carrying out expansion and contraction tests on refractory materials. Their facility for producing even temperatures and controllable atmospheres make them peculiarly suitable for this work. They are being worked at temperatures up to 1500° C.

The principle of radiant heating has also been successfully applied to the heating of tar and oil stills where temperature control is of the utmost importance. For brass, copper, aluminium, and nickel melting, the results obtainable are better than with any other type of equipment when used under similar conditions and without recuperation.

It is only in recent years that the heat of waste gases from town's gas heated furnaces has been used for preheating the air. These furnaces, of the regenerative type, have shown much improved results over the usual type of non-regenerative furnace. They are, however, bulky, and have a large external radiating surface; and while they are a considerable advance on previous practice, one suspects that they do not make as full use of the waste heat as they should. I am much inclined to prefer the continuous recuperative principle described by Mr. Newton Booth, of the Woolwich Arsenal, in his William Young Memorial lecture; and I look forward to seeing an extension of its use. It has the great advantage of small bulk and continuity, together with the elimination of change-over gear.

My object is to stir-up further interest in industrial heating problems, and to enthuse you with the idea that industrial gas must receive more attention by the gas salesman. Generally speaking, gas for any other purpose is relatively easy to sell; and there is still a lack of conviction that there is an enormous field in industry for town's gas. Once the idea has been fully accepted by the gas man, it will be much easier to convince the industrialist. But if the gas man lacks conviction, or technical knowledge and experience in its application, it will be next to impossible to bring conviction to the industrial consumer.

DISCUSSION.

Dr. C. M. WALTER (Birmingham) did not think they had a furnace working exactly on the principle described by Dr. Smith, but were hoping to have one in the near future. The development of gas for industrial purposes lay in the increase of efficiency; and they had a long way to go in this matter. The electrical furnace had an efficiency from 70 to over 90 p.ct.; so that the scope of the electrical engineers was more restricted than in the case of the gas engineers. They started originally with efficiencies of 10 p.ct., and now the figure was 40 p.ct. with a modern type of regenerator. This had to be improved; and he believed there would no difficulty in getting 70 p.ct. with properly designed recuperators. The question of the improvement of the furnace was of vital importance; and his regret was that hitherto it had not received more attention. He would like to have been able to examine figures of efficiency in various connections. The direct-fired furnace would always have its useful application, especially where the operation was intermittent, and where the furnace was used for only a short period. Where it was continuous, as in annealing, &c., they had only to choose between two types—the regenerator and the recuperator.

Mr. H. R. HEMS (Birmingham) said there were many points they were in agreement with, especially the six distinctive features mentioned by Dr. Smith. They were all ideals; and it became a question to them and the consumer as to how best to obtain them. The value of the proportioning systems was extremely great, and that necessitated the human element, or the system of mixing with the compressor. Such ideals had, of course, to be looked at from the point of view of the consumer. Many of them meant capital outlay; so that much caution was necessary. As to the result of the excess of air on furnace work, they all agreed with that. This could be determined by any simple test on any type of furnace. The control of the atmosphere was very important to the manufacturer, particularly in connection with the delicate heat-treatment of steel, &c. The process explained by Dr. Smith necessitated a high-pressure supply. They had this in

* See "JOURNAL," Oct. 5, p. 34.

Birmingham; but where it did not exist, a gas-compressing plant was essential. The paper dealt also with the whole industry. The question of reliance of pressure and of quality was of special concern particularly during the war period. For furnace work, it was most essential that these should be dependable. The possibilities of industrial gas for any undertakings were immeasurable. In Birmingham a huge amount of experimental work had been done, and all sorts of new inquiries came along in regard to matters about which they thought they had reached the limit. The furnace maker had not a great deal to gain out of the furnaces sold; but the gas undertaking was continually getting its profits on the gas used in the furnaces. As to the question of gas development, it was necessary with some undertakings to start more or less over again, owing to the loss of consumers. It was essential that they should be got back again; and to do this it might be desirable to train a special staff with an equipment for experimental work. It was, he supposed, impossible to standardize the furnace to make any reasonable profit out of it, for the applications were constantly changing.

Mr. T. F. E. RHEAD (Birmingham) said he had seen at work one of the furnaces described, and was impressed by the even temperature that was obtained. It was remarkable, and appeared to be due to heating by radiation and products of combustion; for there was no direct flame contact with the material. Whether or not it was actual surface combustion, was open to a certain amount of discussion. The first part of the paper appealed to him strongly; and he regarded as very timely Dr. Smith's warning about rushing to low quality gas. Those who had plenty of distribution margin at present probably did not realize what they would be up-against later on with increased demand, when they had to put in new mains if they declared too low a C.V. gas. In Birmingham, they had got almost to their top notch with their distributive system. As to advertising, his sympathy was with those who had to push gas sales just at present. It would, in his judgment, be far better to spend the money on research work. It was very necessary that the business side of the gas industry should understand what was meant by efficiency, and particularly in relation to furnaces.

Mr. R. G. MARSH (Birmingham) inquired whether the surface combustion principle, as applied to the metal-melting furnace, was claimed to have a higher efficiency than the direct-fired furnace in which were used iron pots, and which had a high-temperature flame in contact. There was a limit to the efficiency to be obtained with such a furnace where there was no regenerative or recuperative principle employed. The products of combustion had to pass away at practically the temperature of combustion. Could higher efficiency be obtained by using the surface principle in such a furnace?

Mr. J. W. WOOD (Leeds University) pointed out that Dr. Smith had laid great stress upon the importance of increasing gas sales by taking-on the industrial load; but he had confined himself in his observations almost entirely to furnaces. There had been some talk in other directions—namely, of firing boilers, particularly those boilers where there was no heavy load, with town's gas. With a similar type of boiler, the Bonecourt, the whole of the refractory material had been removed. In the original literature much was claimed for the refractory material, yet now the tube content was free from this. He had had some little experience with boilers of that pattern; and one difficulty was the breaking-down of refractory material, which became pasty if it were not of a sufficiently good quality. Why was it necessary to pass in such great excesses of air? In the ordinary way there was a considerable amount of air; and he would like to know how the rest of the air was introduced.

Dr. SMITH: By a booster.

Mr. WOOD next asked, if the atmosphere were neutral or slightly oxidizing, was it not possible for the oxides in the furnace or the oxides in refractory materials to react with the materials in the furnace, even though the atmosphere was slightly oxidizing?

Mr. G. E. BURDEN (Redditch) pointed out that those who were contemplating using gas for industrial purposes required some demonstrative evidence as to what could be achieved. It was not easy to induce people to spend (say) £100 on a furnace merely on the strength of his personal assurance on a particular point. It would make things easier if the smaller gas undertakings went to the expense of paying a fully-trained furnace expert, and equipped a good demonstration room with a number of furnaces of different types.

The PRESIDENT commented upon the necessity, from the manufacturing point of view, of obtaining and distributing the greatest number of therms from a ton of coal. The proportioning device seemed particularly worthy of note; and it occurred to him that it was capable of application to forms of gas-consuming appliances other than gas-furnaces. The figures given were astounding in their close approximation of ideal conditions in the percentage of CO_2 in flue gas and in the amount of oxygen actually used for combustion. The difficulty he had experienced with gas-fired furnaces had not been the fact that it had been difficult to convince a possible consumer as to the efficiency of a furnace, but the fact that the articles he wished to heat were of a peculiar size or shape, and required more than ordinary means of handling. This point could be overcome only by the introduction of an industrial sales engineer. All undertakings were not large enough to justify the appointment of such an officer; but it appeared to him that this matter might be overcome by relatively small undertakings co-operating, and having one such engineer to act for several undertakings. He regarded the question of the easy control of the atmosphere of furnaces one of great desirability. If a job had to be taken from the furnace at a high temperature to be quenched, it would naturally be exposed to the exterior atmosphere; and it seemed to him that some regard must be had for this contingency by some provision being made. He had been informed that some sulphur compounds were responsible for the formation of a peculiar and undesirable scale on steels when heated, and he wondered whether, in a surface-combustion furnace of this type, the sulphur oxide could be prevented.

Mr. W. J. PICKERING (Birmingham) moved a vote of thanks.

Mr. L. H. THOMAS (Birmingham), in seconding the resolution, said he regarded it as a compliment to themselves, as a Junior Association, that a paper of such importance and far-reaching interest should have been given at one of their meetings. They felt therefore a keen sense of indebtedness to Dr. Smith for his consideration. Experience had shown in South Staffordshire that manufacturers were partial to a low-grade gas at a medium pressure for industrial purposes; and it seemed to him that in Birmingham it might be well to consider the position as to the future. There, they were nearly at the limit of their distributive system. It might be desirable to consider the question of supplying for industrial purposes a lower-grade gas at a rather higher pressure through a separate main.

The resolution was unanimously approved.

Dr. SMITH acknowledged the compliment, and replied briefly on the discussion. He did not want it to be understood that he was against the use of low-grade gas. Low-grade gas for industrial purposes, if it could be got at the right pressure, was equally as good as most high-grade gas. The cost of distribution was, at the present, anything from 33 to 50 p.ct. of the cost of the gas. In spite of this, there were various conditions that would justify the use of low-grade gas. It had been suggested that inspirators might be applied to gas-fires, cookers, &c. Those who had experimented with them had recognized, however, that it was only when the inspirators were above a given size that one obtained these improved efficiencies. With this particular inspirator it was possible to vary the consumption over a very wide range, and to get the same proportion of air to gas at the burner. The surface combustion equipment was divided into two classes—the high-pressure gas equipment, and the air-blast equipment. Personally, he was a strong believer in advertising; and he believed it was a good thing to continue it. In continuing this he thought the British Commercial Gas Association were doing wisely; but he considered there was something better than advertising. There was the duty on the part of the Gas Council to carry out more research. He suspected it as probable that those who were providing the money for researches were carefully considering whether the researches should not come to an end, or be restricted in the future. "I consider it would be an absolute crime and disgrace to the gas industry," added Dr. Smith, "if any of the researches, which are useful, are in any way curtailed at the present time simply because of financial stringency." [Hear, hear.] Continuing, he said he thought, as regarded gas sales, that the British Commercial Gas Association might go a step further. Advertising was all very well up to a point; but he would certainly like to see the Gas Association get round them a number of industrial specialists somewhat in the form of a "flying squadron" to be drafted into areas where there were no such men to advise manufacturers on the use of gaseous fuel. As to metal-melting in iron pots, he had observed some in Birmingham recently; and he felt there was very little to be done in improving the furnaces he had seen. As to aeration, in view of the fact that complete aeration was not being attained, it was probable that complete aeration would give a more highly concentrated temperature, and that they would get a still greater proportion of heat into the metal. He did not feel it was advisable to suggest that gas undertakings should supply furnaces on hire. It would be better to encourage the sale of furnaces at cost, and for the gas companies to divide a small fraction of the advantage between themselves and the gas-furnace maker—by allowing (say) ½d. per 1000 c.ft. to the maker on the gas used. It had been found that there was not much advantage in having refractories in the tubes of the Bonecourt boilers. The chief essential was a high velocity of products of combustion so as to ensure a scouring action all round the tubes. The question had been asked: How did the products of combustion in surface combustion furnaces get away? Along the side of the muffle there was not one continuous burner, but one every 18 ins.; and the impact was such that a little went under the working bed, but the bulk of the products went up the sides. As to the question of corrosion in controlled atmospheres, Dr. Smith observed that if the materials undergoing heat-treatment were liable to be attacked by impurities in the gas, such as sulphur, &c., that attack would take place whatever else was done to maintain the conditions. Oxidation or reduction could be effected at will.

A successful meeting then terminated.

Gas Lighting in the United States.

The latest figures available at the headquarters of the American Gas Association, stated Mr. F. R. Barnitz, in a report presented, on behalf of a Committee, at the recent annual congress, would indicate that approximately 20 p.ct. of the gas sold by gas companies in the United States is used for lighting; and therefore it is of the utmost importance to the industry that this gas consumption should be retained, and that companies should do all they can to increase their sales in the gas-lighting field. The organization of a thoroughly up-to-date lighting division—a maintenance and selling department—is absolutely necessary in order to retain the business. The men employed in this branch would be given the title of lighting inspectors, and should devote approximately 40 p.ct. of their time to maintenance work, and 60 p.ct. to selling. When the maintenance work occupies more than 40 p.ct. of the time, additional inspectors should be employed, so that at least 60 p.ct. of their time may be devoted to selling. One gas company who have organized such a division, report that during the first year of its operation (1918) their sales of lighting units and accessories amounted to $23,870; and in 1920, to $125,252, or an increase of 425 p.ct. Another large gas company and its affiliated undertakings in the same territory, who organized in 1917 a lighting division for sales and maintenance, report that during the first year the sales amounted to $68,000; whereas for 1920 they were $486,750, or an increase of 615 p.ct. In addition to the regular sales activity, the Committee are of opinion that gas companies should conduct periodical campaigns in connection with gas lighting appliances. It has been suggested to the Committee that an Illuminating Engineering Bureau should be a part of the American Gas Association, and that the work of the bureau should be to standardize gas lighting units as to candle power and gas consumption.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Visit to the Cowdenbeath Gas-Works.

A visit to the Cowdenbeath Gas-Works took place on Saturday, Dec. 10. The members responded heartily to the invitation; and a company of over forty were present. They were met by the Engineer and Manager (Mr. J. J. Scott) and the Chairman of the Cowdenbeath Gas Company (Mr. James Hutton). Every opportunity was accorded the visitors of inspecting the works, and much interest was evinced in the new Humphreys and Glasgow water-gas plant.

After the tour of inspection, the members were entertained to tea—Mr. HUTTON presiding.

The CHAIRMAN, in welcoming the Association, said he was glad to see such a large turn-out of Juniors. He reminded them that as one day they would be the Seniors, it was up to them now to gain all the knowledge that they could.

The PRESIDENT (Mr. A. M'Donald) asked the members to accord to the Cowdenbeath Gas Company their appreciation of the kindness shown that afternoon, and complimented the Company on having such efficient plant in their works.

A hearty vote of thanks was accorded.

THE BUSINESS MEETING.

The PRESIDENT said he had much pleasure in calling on Mr. J. J. Scott to read his paper, on

DEPOSIT IN STEEL PIPES.

The text of the paper was given in the "JOURNAL" last week (pp. 750, 751); and the following is a report of the discussion to which it gave rise:

The PRESIDENT said the Association were grateful for the services rendered to them that day by Mr. Scott in producing such an instructive paper on a subject which would give the members much scope for study and debate. Before inviting discussion, he would ask Mr. H. S. Gemmell, F.I.C., the Official Analyst to the North British Association of Gas Managers, to address the meeting.

Mr. GEMMELL said he was indebted to Mr. Scott for his paper. This trouble of deposit in steel pipes was much more widespread than generally supposed. Some gas engineers might not care to ventilate or speak of this kind of trouble, because they considered it might reflect upon their management. Such action was unwise, and to the Juniors he would give this advice: "Don't be afraid to ventilate your troubles and difficulties, or to confess your ignorance. It is only by talking over the matter with other men you will get light on the subject." He found, on reference to his book, that he had quite a number of the deposits sent in for analysis. The ferrocyanide of potassium was, he found, as high as 13 or 14 p.ct.; while the Fe_2O_3 content ranged from 30 to 66 p.ct. It was at one time suspected that the deposits were oxide from the purifiers carried forward; but this idea was now exploded. It was found that the oxide in the mains contained no peat where bog ore was used, and that the cyanide in the deposits was much greater than that in the purifiers. It was now established that it was the HCN in the gas that was chiefly responsible for corrosive action on the metal—possibly in combination with oxygen in the air used for revivification. It was doubtful what exactly the action was; but probably the Fe_2O_3 + HCN from the ferrous cyanide was oxidized to ferric cyanide, and finally into prussian blue and Fe_2O_3, and, according to the equations, there was twice as much Fe_2O_3 at the end of the reaction as at the beginning. He was doubtful if the extraction of the cyanide would be a paying proposition in smaller works as regards the price of the cyanide for sale; but its removal might have some direct advantage. A large proportion of the cyanide was absorbed in the purifiers; and the oxide, in combination with the cyanide, was not available as an absorber for sulphur, and the efficiency of the oxide was thereby reduced. There was also the action of the HCN gas on the holder plates and the fouling of the holder water, and a very pronounced action on the metal of the governors, station meters, and mains. He had seen a station meter with the metal pitted with holes and covered with prussian blue. In the report of the "Life of Gas-Meters Committee," they stated that: (1) HCN is the primary cause of this pitting, and the action is probably increased by the presence of oxygen; (2) the absence of lime in the purification of the gas now allows the HCN to go forward; and (3) the oxygen used for revification hinders the more complete extraction by the oxide. He also stated that the presence of water was an essential condition for this corrosion; and there was said to be increased condensation in the mains and services owing to the lack of carrying power of the stripped gas. This would account for the fact that the corrosion was now prevalent in high-pressure and low-pressure mains. The compression raising the temperature and the capacity of the gas for absorbing water naturally deposited this water on cooling. It would therefore be necessary to cool the compressed gas before it entered and collect the condensate, which contains the ingredients, theocyanide and ferrocyanide—agents which were known to give rise to corrosion.

Mr. Gemmell was heartily thanked for his valuable contribution to the discussion.

The PRESIDENT then asked the members to ventilate their views or experiences on this subject.

Mr. W. LINTON (Edinburgh) said he was much interested on this question, not only in gas-mains but in water-mains. The deposit in water-mains could be readily adjusted by extraction of harmful matter at the source of supply. The concrete pipes now being made might remedy the matter somewhat; but as yet nothing of small diameter had been used to take the place of iron and steel.

Mr. JAMES HUTTON (Messrs. Alder and Mackay) said that it was a matter of great importance to meter manufacturers as well as gas engineers; and he impressed on gas engineers the importance of having a gas free from these chemicals so injurious to gas-meters and other plant.

Mr. W. A. DEARDEN (Dunfermline) mentioned similar experiences to those of Mr. Scott at Dunfermline. They used paraffin, which acted as a solvent; and, in the case of the 5-in. high-pressure main to Rosyth, they had to plug the main and put on pressure to 150 in. to blow the deposit out.

More profitable and interesting discussion took place; and Mr. SCOTT replied to all the questions in competent fashion.

THE SOCIAL SIDE.

A pleasant evening was thereafter spent in song and sentiment.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

A largely attended meeting of the Association was held in the Royal Technical College, Glasgow, on last Saturday week, Mr. JAMES CUBIE (the President) in the chair.

The PRESIDENT at the outset reported regarding what had transpired at the Joint Council meeting of the English and Scottish Junior Associations which was held in Leeds on Thursday, Nov. 17. In inviting discussion on the report, he said he personally had the feeling that nothing was to be gained by affiliation. It was quite evident that in Scotland the Juniors proceeded on quite different lines from the English Associations. Then it must not be forgotten that, under the prevailing *régime*, the Juniors in Scotland were doing particularly well. It was apparent from what had transpired at the Joint Council meeting that, in the event of the Scottish Juniors affiliating with the English Association, they would be expected to adopt the constitution of the latter. There was no use otherwise in affiliating; and in the circumstances, he moved that affiliation should not be considered further.

After an interchange of views, the motion ultimately became the unanimous finding of the meeting.

The PRESIDENT subsequently announced that no questions had been forwarded to the Secretary for elucidation and explanation in regard to the points raised by Mr. Sim in the course of his paper at the last monthly meeting. This being so, he would call upon Mr. Archibald Wylie, Chief Distribution Clerk, Glasgow, to read his paper on "Complaints and Inquiries."

The main portions of Mr. Wylie's paper will be found on p. 749 of last week's "JOURNAL."

DISCUSSION.

Mr. JOHN M'ISAAC (Milan Street, Glasgow) thought it would be agreed that the subject raised by the author was one with which they were mostly familiar. It was a theme that might be said to affect their tempers, because "complaints" belonged to a class of work which they desired to avoid. Complaints were not pleasant matters to deal with. The sifting-out and investigation of them often tested the temper and tried the patience. Nevertheless, while he said so much, he thought the remedy lay obviously to their own hands. The author had tried to clear the way for a better understanding between the Complaints' and Engineers' Departments and the workshop; and while he personally appreciated his efforts in this direction, he failed to grasp Mr. Wylie's point that this "bond of connection" should be regarded as the hub of the entire concern. He had the feeling that the idea propounded by Mr. Wylie—that the complaints section should test the pulse and weakness of a whole concern—sounded managerial. It might be an advantageous thing so far as the clerical requirements of the complaints section were concerned; but it could not operate advantageously otherwise. The checking of weakness in gas addition was in his opinion a matter for individual supervision; and anyone having such authority was out of place in the complaints section. Another point which required to be emphasized was the question of technical knowledge. In no other place would more scope for its use be found than in the complaints section. There was also practical knowledge; and this was a serious problem for many ambitious men. Both these points affected all grades of men, because they had the clerk with technical but little or no practical knowledge, and the practical man *vice versâ*. The question then came to be, Who was the better man? His own opinion was that personality counted; but this was not the ideal. In this theme alone there was a golden opportunity for a live discussion.

Mr. W. BEGG said he disagreed with Mr. Wylie's classification of complaints. A "removal" was not a "complaint," but a flitting; and flitting was a disease. He protested against the deduction made by Mr. Wylie that complaints received had not been notified; and appealed to him, in all fairness, to withdraw it.

Mr. JOHN TAYLOR (Wall Street, Glasgow) followed; and the discussion was continued by Messrs. ALEXANDER, WM. HOGG, and LAMBIE.

The point was made by Mr. HOGG that, if they all worked up to Mr. Wylie's advice never to minimize complaints because the consumer was serious, there would be little need of complaints from the Gas Department stating that the meter was too small, and so on. It would be the duty of the distribution inspector to see that these essential details were carried out. In the course of the paper, the author had in an idealistic strain reviewed many points. It was a contribution that would repay close study. In particular, it would be noticed that Mr. Wylie referred to rust in the mains. Here was a wide and debatable point, because, where rusting took place, the service-pipes were too small. It was undoubtedly a common complaint. Most cordially did he approve of the suggestion put forward by the author that the Gas Department should take the responsibility of putting in larger service-pipes. If this

were done, he was positive the plan would result in increased revenue. With regard to Mr. Wylie's proposal for a charge on sub-lets, Mr. Hogg drew from his own experience in North Berwick, where a charge of 6*l.* was made for visitation on every person who had sub-let a house, at the termination of occupation.

The discussion was carried on by Messrs. CHERRIE, W. M. PATERSON (Tradeston), and MUNRO.

COKE-OVEN MANAGERS' ASSOCIATION.

(NORTH OF ENGLAND DISTRICT)

Presidential Address.

Mr. A. H. THWAITE, the newly-elected President of the North of England Coke-Oven Managers' Association, delivered his inaugural address at a meeting of the members at Durham on Saturday, Dec. 10.

Thanking the members for electing him President, Mr. Thwaite said he could not do much without their individual assistance in endeavouring to promote more interest in the Northern Section, and thus encourage a better attendance of members at the meetings. He realized the very difficult times their industry had been through since the formation of the Association; and those unfortunate circumstances had undoubtedly interrupted interest and attendance to some extent. He trusted, however, that, when normal conditions were re-established in their works, it would give members time and opportunity to use the objects of the Association more deservingly. He reminded them that Rule 2 stated the object for which the Association was established —"to promote the coke-oven and bye-product industry in all or any of its branches." This, therefore, gave a very wide field and afforded much scope for interesting papers. He appealed to all to use their utmost endeavours to improve the status of the Association, not only for their own interests, but in the interests of their employers; and he felt it was only by such means they could attain success and establish confidence with the owners—thus gaining their support in assisting the aims of the Association.

MANIPULATING PLANT DURING A DISPUTE.

For his address he proposed to deal very briefly with subjects which he thought might induce members to give papers for the current session, as at present there was no definite programme fixed. He took as his first subject "The Best Means of Manipulating a Bye-Product Coke-Oven Plant During a Dispute." They had all, of late, had some very valuable experience in this respect; and he was aware that there were many different and decided opinions as to the best method of dealing with such a position. There were, in addition, so many considerations to be taken into account that it was a complex subject to deal with briefly. He suggested three methods, however, placing them under the following heads and then considering their advantages and disadvantages.

(1) Drawing the least possible number of ovens to maintain gas supply for heating the oven walls.
(2) Bee-hiving bye-product coke-ovens.
(3) Total shut-down of ovens and plant, leaving hot coke in ovens.

Dealing with the first, the main advantages of such a method would be to keep the oven heats in such a condition that the remainder of the battery could be rapidly re-started when the men resumed work; thus avoiding hand firing or bee-hiving. It would reduce serious contraction of the brickwork in oven walls and main waste-heat flues, of buckstaves, tie-rods, hydraulic, and gas suction mains. The bye-product plant would also be kept at work, thus recovering tar and ammonia. The disadvantages that occurred could be summed-up by the risks and difficulties of maintaining an adequate supply of gas, which required most careful supervision. Also, in the majority of cases there was the difficulty of disposing of the coke, which, in the event of stocking being resorted to, was a costly item. There were times when it was necessary to discharge ovens before they were thoroughly carbonized, which often resulted in damage to the ram and the oven walls. There was, too, the loss in benzole, where benzole recovery plant was installed. Such a system was, as a rule, dependent on an outside supply of electric power; and last, but not least, there was the difficulty of arranging adequate labour to run on this system.

Regarding No. (2)—bee-hiving bye-product ovens. On this method considerations largely depended upon the type of oven to be bee-hived. Some were much more difficult to dealt with than others, owing to peculiarities of design. But, assuming that they could be worked satisfactorily on this system, there were many points in its favour, chief of which was that carbonization was capable of being extended over a longer period than when dependent upon a gas supply for heating the oven walls as in the first method. There was not the same risk of explosion, and the labour required was small compared with No. 1 method. This gave the staff opportunities to do repairs to the bye-product plant when necessary. The heats could also be rapidly increased when the men returned to work, and the contraction of the oven wall brickwork was not so serious. The disadvantages were that the coke was not always good, and, owing to the low temperature it was burnt at, it required additional labour to break-up the very large pieces of coke. This, too, had to be stocked, which was, again, expensive. Where there was no means of taking the gases from the ovens into wall combustion flues and to the main flue and the chimney, there was the risk of damage to the brickwork of the main flue due to the oven being hot and the main flue cold. Finally, the total loss of bye-products from the coal was very serious.

The total shutting-down of plant, leaving hot coke in the ovens, was a method to which he was afraid many had to resort during this year's three months' lock-out, owing to the depletion of coal stocks. There were many plants still in this unfortunate position. The consideration of any advantages of this system depended very largely upon whether the ovens were arranged with flues to take the gases direct from the ovens into wall combustion flues and then into the main flue and chimney. Assuming the ovens had this arrangement, it was quite possible, by keeping the hot coke in the ovens and carefully sealing them up at the sole dampers, ascension pipes, charge holes, and doors, to reserve heat in the ovens for a period of one month and, in some cases, for six weeks, having after this period sufficient in the walls to discharge the coke, reload with coal, and obtain sufficient gas from the freshly-loaded ovens to couple them to the bye-product plant.

When the heats got below a safe temperature for re-starting on a bye-product plant, it was necessary to make preparation for hand-firing the ovens; but rather than resort to this method, some managements charged coal on top of the coke. This, however, was not to be recommended, as trouble was generally experienced when the time came to discharge the ovens. Before hand-firing was started, after discharging the coke, it was desirable to allow the ovens to cool down to a point which made it possible for masons carefully to stop-up with fire-clay cement cracks in the oven walls. Providing the ovens were reasonably gas-tight, it was possible to get the heats up and the ovens charged and on to the plant within two weeks, and sometimes even less. Among other advantages of this method were the saving of coal and bye-products (even after making allowance for that consumed in hand-firing); that it was much more economical than the other two methods; saving in labour in the absence of handling and tipping coke; saving of power for running plant; and, lastly, the opportunities given for carrying out the repairs to plant. The disadvantages of such a system were the loss of coke through standing in the ovens; possible labour cost for hand-firing; and depreciation to brickwork through contraction.

In his opinion, the most economical way of manipulating a plant in lock-out circumstances would be to erect suitably-designed gas producers, which would be equipped with mechanical means for charging the fuel and discharging the ashes. If these were at hand, and the hot coke left in the ovens, the amount of gas necessary to keep the desired number of ovens at a suitable temperature for rapidly restarting would, he thought, be comparatively small. The capital cost for such a plant would doubtless be heavy; but it would appear that it would soon repay its cost, as compared with the expense incurred in hand-firing a plant on the three systems mentioned.

PLANT DESIGNED ON AMERICAN LINES.

Another subject frequently discussed was the American system of bye-product coke-oven practice. Personally, he thought the whole question rested upon the doubt as to whether the resultant coke from a plant designed on American lines would be suitable for our blast-furnace system. They all knew that high temperature in coke-ovens produced very small coke; and he believed he was correct in stating that there was a certain prejudice on the part of ironmasters against bye-product coke when first produced in this country, mainly for the reason that the coke made in bye-product ovens was smaller than that from bee-hive ovens. But, by altering the method of working in the blast-furnaces, it was eventually found that they could work the furnaces with bye-product coke equally as well as with the bee-hive coke. As to whether the same would apply to high-temperature bye-product coke was doubtful, as, he believed, the American furnaces were designed on special lines to suit small coke. He thought it was a matter that should be carefully considered by the ironmasters before a colliery company erected a plant on American lines. The outputs of American coking plants were astounding as compared with their own; and he hoped he would be pardoned for taking the liberty of suggesting that a paper on American coking practice would be most welcome if given by a northern member who had seen the plants at work.

Corrosion of Buried Pipes.—An extensive investigation of the corrosive action of soil on pipes used for gas and water mains and service-pipes has been undertaken in the United States by the Bureau of Standards of the Department of Commerce. The Bureau have the co-operation of the Bureau of Soils, the pipe manufacturers, and the public utilities through the Research Sub-Committee of the American Committee on Electrolysis. Forty locations have been selected as representative of the principal families of soils to be found throughout the United States, and at each will be buried a number of samples of every kind of iron and steel pipe in commercial use. These field tests will be supplemented by laboratory tests, which will give complete data on the physical and chemical properties of the soil and on the microstructure, complete metallurgical history, and chemical analysis of the pipe specimens. It is, says a correspondent of the "Journal of Industrial and Engineering Chemistry," expected that the experiment will continue for eight or ten years.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

American Gas Association and the Institution of Gas Engineers.

SIR,—The President (Mr. Thomas Hardie) directs me to send to you, for the favour of publication, the following copy of letter which has been received this morning from the American Gas Association.

WALTER T. DUNN, Secretary.

Institution of Gas Engineers, No. 28, Grosvenor Gardens, S.W., Dec. 17, 1921.

[ENCLOSURE.]

Dec. 7, 1921.

Dear Mr. Dunn,—Thank you very much for your note of Nov. 28, acknowledging the receipt of my letter which advises you of the action taken by the American Gas Association in electing to honorary membership the President of the Institution of Gas Engineers for his term of office.

Also permit me to send you this belated acknowledgment of the thoughtful cablegram dispatched to us at the time of our annual meeting. This was read to our membership in one of our general sessions; and I can assure you it was heartily appreciated. At the meeting of our Executive Board just held, I was directed to express the appreciation of our officers and Executive Board for this thoughtful action, and take this opportunity of doing so, instead of forwarding the separate communication I was about to prepare when your note arrived.

Whenever the American Gas Association can be of service to you, I hope you will not hesitate to call upon us. If any members of your Institution are visiting the United States, and we can advance the purposes of their visit, or extend any courtesy or attention to them, I hope that you will have no hesitancy in giving us the opportunity to do so. If you should at any time desire information, or there should arise any matter in which the Association or myself personally can be of service, please command me.

(Signed) OSCAR H. FOGG,
Secretary-Manager.

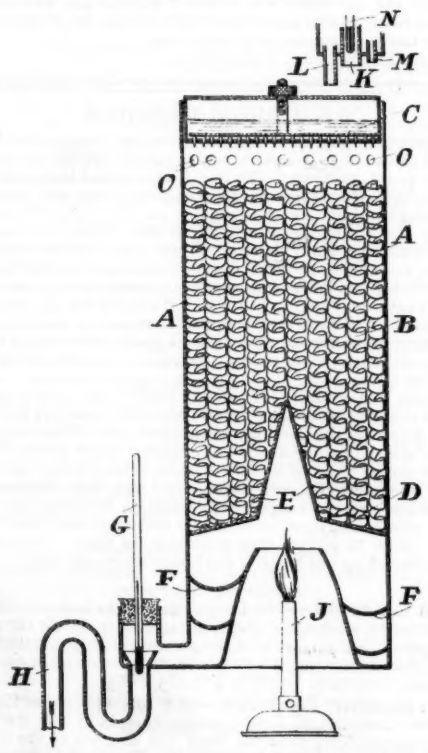
REGISTER OF PATENTS.

Gas-Calorimeters.—No. 171,246.

DAVIDSON, W. B., of Newcastle-on-Tyne.

No. 26,276; Sept. 13, 1920.

This invention consists broadly of a calorimeter in which the gaseous products of combustion of the test fluid are adapted to come into direct and intimate association with a cooling liquid by passing both the products and the liquid through a common separated, divided, honeycombed, or otherwise perforated medium.



Davidson's Gas-Calorimeter.

A sectional elevation of the calorimeter is shown. The cylindrical shell or casing A is preferably of thin sheet copper; B is a packing contained therein; and C is a device for introducing water in a distributed state into association with the packing. The device C is similar to that described in patent No. 2541 of 1913, and the packing may conveniently be of the special spiral form disclosed in patent No. 26,979 of 1911.

The packing is supported upon an annular grid D and a central cone E; the grid being perforated throughout its area and the cone being provided with a ring of perforations in proximity to its base.

Immediately beneath the grid is a spiral trough F adapted to conduct water to a thermometer G and exit pipe H. A burner J (either bunsen jet or flat-flame) is situated in the recess immediately beneath the central cone. A water delivery device, comprising an inlet pipe K, a delivery pipe L, and a surplus overflow pipe M, is adapted to deliver water to the distributing device C, and a thermometer N is arranged within the pipe K as shown. The shell is lagged with insulating material, and holes O are provided at a level immediately above the top of the packing B.

The operation of the device is as follows: A measured stream of water is delivered to the device C and a measured stream of test gas is simultaneously delivered to the burner J and ignited. The water passes in a finely-distributed state to the packing B, and percolates downwards through it, being guided by the cone E to the grid D, whence it passes through the perforations in the grid to the spiral trough F, and thence to the thermometer G and exit pipe H. At the same time the gaseous products of combustion from the burner pass upwards through the grid and the lower part of the cone and, coming into intimate contact with the descending finely-divided films of water, give-up their heat and issue from the free space at the top of the packing through the holes O in the shell practically at atmospheric temperature.

After the device has been in operation for some minutes, steady conditions will maintain, and the average temperature difference between the two thermometers G and N over an interval of about ten minutes—for example, taken in conjunction with simultaneous measurements of the gas supplied to, and the water passing through the instrument—provide means for "determining accurately the gross calorific value of the test gas."

Manufacture of Coal Gas.—No. 171,282.

THERMAL INDUSTRIAL AND CHEMICAL (T.I.C.) RESEARCH COMPANY, LTD., and MORGAN, J. S., of Grosvenor Gardens, S.W.

No. 28,344; Oct. 6, 1920.

In the manufacture of coal gas, the patentees remark, coal is destructively distilled on a small scale for the purpose of testing the value of the coal; such portion of the gas as is not required for the test being passed to the distributing mains. This testing distillation lacks accuracy, because of the difficulty of securing conditions of temperature identical with two samples. In consequence, the manufacture of gas on the large scale suffers for want of correct information.

By the present invention the manufacture of gas is said to be improved by totally immersing the coal in a bath of molten metal kept at a constant desired temperature. The products of carbonization are collected from the surface of the bath and dealt with in the usual manner.

The destructive distillation of carbonaceous material, by causing it to travel through molten metal in a closed chamber from which the products are withdrawn, has been proposed as an industrial method of carbonizing such material. But this method is not suitable when an accurately weighed quantity of coal is to be carbonized and the products collected quantitatively.

By the present invention the weighed quantity of coal in pieces of the size required is confined in a cage fixed to the end of a plunging rod. The case is quickly thrust through a seal of the molten metal (conveniently lead) into a bell-shaped vessel more or less immersed in the metal and connected at its upper portion with a condenser—the latter connected with a gas-meter. The case is allowed to remain in the molten metal for a definite time, such as two minutes, and then quickly withdrawn.

The temperature of the bath of molten metal being known, the test thus performed gives the yield of products from the coal of a given size in a given time at a given temperature, and repetition of the experiment with alteration of one or other of these conditions gives the information required as to the probable behaviour of the coal on a large scale.

Reduction in Price at Hastings.—Owing mainly to the lower cost of coal, it will be possible for the Hastings and St. Leonards Gas Company to reduce the price of gas as from the Christmas reading of the meters. The new price will be announced as soon as possible. In making this intimation, the Engineer and General Manager (Mr. C. F. Botley) directs the attention of consumers to the success and economy of up-to-date inverted burners, with comfortable illumination and ventilation effect; and he urges them "to avoid the use of inferior incandescent burners now on the market, which, however attractive in price, are inefficient and quickly deteriorate."

Gas or Electricity for Barry.—The question of gas *v.* electricity was further debated at a meeting of the Barry Urban District Council last week, when letters were read from the Barry Railway Company, a number of ship-repairing and engineering works at the docks, and the Amalgamated Engineers' Union, calling upon the Council to fully investigate the cost of electric lighting for the town before incurring an expenditure of £125,000 for the renovation and extension of the gas-works. Mr. C. B. Griffiths (the Chairman of the Gas Committee) said if electric lighting was secured, it would obviate the necessity of improvements at the gas-works. The Gas Manager (Mr. T. E. Franklin) declared that it was imperative that extensions should be made at the works, as there was a great element of danger in operating the present plant to its maximum capacity. By fifteen votes to four, the Council cancelled the resolution authorizing the expenditure of £125,000 on the gas-works, and referred the matter back to the Committee to carry out further investigations.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Foreign Gas-Mantles and Taxation.

Sir W. BARTON asked the President of the Board of Trade whether his attention had been called to the decision of the Referee appointed by the Lord Chancellor, under the Safeguarding of Industries Act, that incandescent gas-mantles, in so far as certain materials used in their manufacture were concerned, were liable for duty; and whether he intended to apply to the Referee for his assistance to test this decision in a court of law.

Mr. BALDWIN replied that he was carefully considering the position created by the decision in question; but he was unable to make any statement at present.

Lieut.-Colonel ARCHER-SHEE asked if it was not a fact that last month Germany had doubled the import duty on gas-mantles in order to prevent gas-mantles manufactured in this country from going into Germany.

Sir RYLAND ADKINS asked whether it was not a fact that the House deliberately decided against the inclusion of gas-mantles in the first part of the schedule.

Mr. KILEY asked when Mr. Baldwin expected to be able to give some information on this subject, considering the confusion which undoubtedly existed in the trade.

Sir J. REMNANT asked if the gas-mantles imported into this country from Germany in 1920 exceeded by fifteen times the number imported in 1919, and that, according to the "Times Trade Supplement," the imports this year equalled the total consumption of gas-mantles in this country?

Mr. BALDWIN replied that perhaps it would answer all the questions if he said that he only had the official decision on the 15th inst. He was carefully considering the decision; and he hoped it might be possible to arrive at a conclusion at a very early date. He quite recognized it was essential to the industry that this should be done at once.

Coal Smoke Abatement.

Mr. J. JONES asked the President of the Board of Trade whether, in view of the injury to health and the damage to property and goods in the Metropolitan area, estimated at some millions of pounds, due to the recent fogs, any steps had been taken by the Government towards the abatement of coal smoke; and whether the recent developments in the manufacture of a smokeless fuel for household and industrial use at works near Barnsley had come to the knowledge of the Board of Trade.

Mr. BALDWIN replied that the question of the abatement of coal smoke had been engaging the active attention of the Government since 1917, and research into this problem had been continuously undertaken by the Fuel Research Board under the Department of Scientific and Industrial Research. The Board were fully informed of the work on this problem being done by other organizations, not only at Barnsley, but elsewhere.

LEGAL INTELLIGENCE.

DEMURRAGE ON A STRIKE-PERIOD COAL CARGO.

Attorney-General v. Liverpool Gas Company.

In the King's Bench Division of the High Court of Justice on Monday last, Mr. Justice ROCHE had before him an information by the Attorney-General, on behalf of the Crown, claiming payment of the sum of £3312 8s. 6d., being the balance of the purchase price of 7076 tons 2 cwt. of gas coal delivered to the Company in August, 1919, upon the terms that they would pay such price for the same as was reasonable in the circumstances. The price was £19,967 10s. 4d., of which £16,655 1s. 10d. had been paid Defendants denied the agreement, and said they were not indebted as alleged.

The ATTORNEY-GENERAL and Mr. BOUSTEAD appeared for plaintiff; Mr. DISTURNAL, K.C., and Mr. TINDALE DAVIS for the defendants.

The ATTORNEY-GENERAL said the three items in dispute were demurrage, overtime, and the cost of discharging the ship. The invoice price of the coal having been paid, defendants had now signified their willingness to pay the cost of discharging and overtime, though they still disputed any liability to pay demurrage. The short facts were as follows: In consequence of the coal strike in Yorksbire in 1919, there was a great shortage of coal in certain places, particularly for domestic and utility purposes; and this was specially the case in Liverpool and Manchester. The Controller therefore diverted cargoes, which had been requisitioned, to places where there was a real danger of running out of coal. The persons who were to receive the coal were notified of its dispatch; and, had they chosen, they could have refused it. Defendant Company were known to be short of coal; and on July 25 the s.s. "Liverpool" was ordered from the Tyne to Garston with 7076 tons; the defendants being advised by telegram of the fact. The name of the Liverpool Gas Company was inserted in the charter party as charterers, though they said this was done without their knowledge or consent; and they now refused to pay the charge for demurrage. Defendants were not being sued on the charter party, but on an implied promise to pay the charges reasonably incurred by the Controller in getting the coal to them. His submission was that defendants, having taken the coal which had been diverted to them, were liable to pay all reasonable charges incurred in and about the delivery.

Mr. *James Galbraith* gave evidence that the Coal Controller had done everything possible to expedite the delivery of coal to gas companies during the period of the strike.

In cross-examination, witness admitted that the defendant Company had always repudiated the demurrage claim on the ground that they had had nothing to do with the discharge of the vessel. Defendants were named as charterers without their knowledge or consent.

Mr. *James Helps*, District Superintendent for the Coal Controller in the Northern Area, said Mr. Gibson, the Engineer of the Gas Company, said he would like to have the coal, which witness could not give him. There was a good deal of delay in unloading owing to shortage of labour and bad weather, and also shortage of trucks.

This was the case for the Crown.

Mr. DISTURNAL, in opening the defendants' case, said his clients had nothing to do with the arrangements for the discharge of the coal beyond naming the particular works to which it was to be sent. This being so, it was difficult to see on what ground they could be charged with the demurrage. The only contract with the Controller was for the supply of coal—the price was never agreed further than that it was to be a reasonable price. All the defendants had to pay was a reasonable charge for conveying the coal to their works; but demurrage, which was really an agreed sum by way of damages for breach of contract, they had nothing to do with. There was no evidence of direct contract to pay unless it could be said to form part of the "reasonable" cost of the coal.

Mr. *R. E. Gibson*, Engineer to the defendant Company, said he was spoken to by Mr. Helps on July 26 about the coal; but nothing whatever was said by any one on behalf of the Coal Controller that the Company should be liable for demurrage. He had nothing to do with the discharge of the ship. All arrangements for discharge and conveyance to the works were carried out by the Coal Controller. He was not informed as to the due date when the ship should have been unloaded; and he knew nothing about the charter party. All through he had taken up the position that the Company were not responsible for the extra cost of transport, and that it was for the Controller to pay the difference in cost between rail and ship.

Mr. Justice ROCHE said the action was brought to recover the sum of £3312 8s. 6d., which was alleged to be due to the Crown under a contract, express or implied, that defendants would pay the reasonable cost of securing a cargo of coal. There was no dispute that defendants were bound to pay the sea freight. The three items in dispute were £2304 for demurrage, £900 for discharge of the ship at Garston Dock, and £99 for overtime. The last two items were not seriously contested by defendants; and the only question was whether any distinction could be drawn between freight, overtime, and demurrage. He thought no such distinction could be drawn; and that defendants were liable to pay the claim in respect of demurrage. The ship was diverted under the powers conferred on the Crown by D.O.R.A.; shipowners not being desirous of undertaking the voyage, as foreign freights were very high at the time, and when so diverted to Garston the rate to be paid was not fixed. He found as a fact that the Controller arranged the very best terms he could with the shipowner in the interests of the defendant Company, and the demurrage clause was inevitably mixed up with the rate for freight. When defendants undertook to abide by the rate for freight, they also undertook to abide by other terms, such, for instance, as demurrage. For defendants it had been urged that demurrage was not part of the cost of transport but a payment made in respect of a breach of contract of carriage; but he did not agree with this contention. The arrangement was to provide coal at a reasonable cost, and to arrange for its carriage to the works and demurrage was part of the inevitable cost incurred without any fault on the part of the Controller. The result was there would be judgment for the Crown for the amount claimed, with costs.

A stay was granted on the usual terms.

Gas Affairs at Chesterfield.

The Chesterfield (Derbyshire) Town Council having decided to increase the price of gas in the borough to 4s. 6d. per 1000 c.ft., Alderman Clark (the Chairman of the Gas Undertaking) has issued a statement regarding the matter. He points out that the increase was mainly brought about by the fact that in the earlier days, the Gas Committee did not advance the price of gas. They had fairly large reserves; but they were prepared to use them for the benefit of the consumers, and they kept down the price as low as possible. Owing to the coal stoppage, however, and the increased cost of coal and other causes, the price now had to be increased at least for the next quarter or two; but the Committee were hopeful that in the near future a reduction would be possible. The price of gas at Chesterfield compared favourably with many other towns. It was the intention of the Council to bring the price down at the earliest possible moment. The Corporation were also reducing the price of coke in the yard as reductions were made in the price of coal. The retorts at the works had been rebuilt, and better results were now being obtained. With wages easier, and—what was more important—a reduction in the price of coal, the Committee hoped soon to be able to reduce the price of gas to something like 2s. to 2s. 6d. per 1000 c.ft. The Gas Committee had intended to have all the lamps in the borough lit during the nights of December and January, at an estimated cost of £3000; but they had now been asked to reduce their estimates by £500. This reduction would be effected by not keeping the lamps alight all night.

Lurgan Gas Profits.—The Lurgan gas-works had a trading profit on the past year's working of £170, as against a deficit the previous year of £1306. The popularity of the penny-in-the slot meter is shown by the fact that the revenue from this source amounted to £8198; that from ordinary consumers totalling £10,983.

Belfast Electricity Breakdown.—At a meeting of the Committee of the Belfast Chamber of Trade, strong complaint was made of the loss and inconvenience resulting from the absence of the municipal electricity supply owing to a breakdown. This had happened on at least two occasions at busy hours of the day. Mr. T. D. Cheyne, J.P., said traders who had an auxiliary installation of gas were wise; and if they went further and put in a gas-engine connected with the dynamo, they would have additional protection. It was decided to make representations to the City Electricity Committee.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following further notice has appeared in the "London Gazette" of an application to the Board of Trade under section 1 of the Gas Regulation Act.

Horley District Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

DECLARATIONS OF CALORIFIC POWER.

Berkhampstead Gas Company.—500 B.Th.U. (Dec. 14)
Canterbury Gas and Water Company.—460 B.Th.U. (Dec. 25.)
Chester United Gas Company.—460 B.Th.U. (Dec. 17.)
Dursley Gas Light and Coke Company.—460 B.Th.U. (Dec. 28.)
Elland-cum-Greetland Gas Company.—450 B.Th.U. (Dec. 16.)
Heathfield and Waldron Gas Light and Coke Company, Ltd.—490 B.Th.U. (Jan. 1.)
Kettering Gas Company.—450 B.Th.U. (Dec. 17.)
Raunds Gas Light and Coke Company, Ltd.—470 B.Th.U. (Dec. 31.)
Stamford and St. Martin's (Stamford Baron) Gas Light and Coke Company.—450 B.Th.U. (Dec. 15.)
Wellington (Salop) Gas Company.—450 B.Th.U. (Dec. 17.)
Woking District Gas Company.—450 B.Th.U. (Dec. 17.)
Worthing Gas Light and Coke Company.—470 B.Th.U. (Dec. 21.)

GAS REGULATION ACT ORDERS.

There have been forwarded by the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Bawtry and District Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 17·8d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by five.

Prepayment meter clauses are included. (Dec. 13.)

Berkhampstead Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 18d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the half year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the half year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by five.

Prepayment meter clauses are included. (Dec. 12.)

Brodsworth and District Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 15d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-seven-tenths.

Prepayment meter clauses are included. (Dec. 15.)

Elland-cum-Greetland Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 15·8d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-one-half. (Dec. 10.)

Malton Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 13·6d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-three-tenths. (Dec. 13.)

Musselburgh Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 15·2d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half.

Prepayment meter charges are included. (Dec. 9.)

Shanklin Gas Company.

After the declared date, the standard prices in respect of gas supplied by the undertakers shall be 18·6d. and 19·8d. per therm; and these prices respectively shall be substituted for the prices of 4s. 6d. and 5s. per 1000 c.ft. mentioned in section 63 (dividends dependent on price charged) of the Shanklin Gas Act, 1907.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half.

Prepayment meter clauses are included. (Dec. 15.)

Sutton Gas Company.

After the declared date, the standard prices in respect of gas supplied by the undertakers shall be 14·6d. and 15·8d. per therm; and these prices respectively shall be substituted for the prices of 3s. 2d. and 3s. 8d. per 1000 c.ft. mentioned in section 38 (sliding-scale) of the Sutton Gas Act, 1904.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half.

Prepayment meter clauses are included. (Dec. 13.)

Taunton Gas Light and Coke Company.

After the declared date: (1) The standard prices in respect of gas supplied by the undertakers shall be 17d. and 18·2d. per therm; and these prices respectively shall be substituted for the prices of 3s. 9d. and 4s. 3d. per 1000 c.ft. mentioned in section 27 (standard price of gas) of the Taunton Gas Act, 1897. (2) The prices of 16·4d. and 17·6d. per therm respectively shall be substituted for the prices of 3s. 6d. and 4s. per 1000 c.ft. mentioned in the second proviso to the said section.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the prices charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half. (Dec. 15.)

Woking District Gas Company.

After the declared date: (1) The standard price in respect of gas supplied by the undertakers shall be 18·2d. per therm. (2) "1·2d. per therm" shall be substituted for "6d. per 1000 c.ft." in sub-section (2) of section 69 (dividend dependent on price charged) of the Woking District Gas Act, 1912.

For the purpose of ascertaining the authorized rate of dividend for the half year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the half year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half.

Prepayment meter clauses are included. (Dec. 15.)

Worthing Gas Light and Coke Company.

After the declared date: (1) The standard price in respect of gas supplied by the undertakers shall be 16·4d. per therm; (2) the price of 15·2d. per therm shall be substituted for the price of 3s. 6d. per 1000 c.ft. mentioned in the proviso to section 30 (fixing price of gas with sliding-scale as to dividend) of the Worthing Gas Order, 1894.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-four-fifths.

After the declared date, "1·2d. per therm" shall be substituted for 6d. per 1000 c.ft. in paragraph (3) of section 35 (for protection of Corporation of Worthing) of the Worthing Gas Act, 1907. (Dec. 13.)

WIDNES AND THE CHEAPEST GAS.

Announcing a reduction in the price of gas, at last week's meeting of the Widnes Town Council, Alderman H. S. Timmis (the Chairman of the Gas Committee) declared that a reputation which was lost during the war had now been regained. He went on to say that for the long period of twenty-five years Widnes had enjoyed the honour of selling gas at a lower price than any other undertaking. The exigencies of the war, however, compelled the Committee to review the situation; and, in consequence, Widnes fell from her exalted position—due in a great measure to the fact that gas-works on the North-East coast, together with a few other places, were permitted to ship coke abroad at enormous prices—a privilege withheld from all Lancashire gas-works, with the result that Widnes lost for a time the premier position in the matter of selling price.

The return to normal conditions brings Widnes again to the forefront of low selling prices of gas. Gas for lighting has been reduced from 2s. 3d. to 2s. 1d. per 1000 c.ft., and for motive power and industrial purposes from 1s. 11d. to 1s. 6d. These prices, it is pointed out, make the Widnes product again the cheapest in the world. The coal dispute and trade depression caused the department to lose a very large sum. Not only will this deficit be wiped-out, but the financial position due to more favourable coal buying and other improved conditions is sufficiently strong to admit of these reductions. The effect of the reductions will be, on an annual consumption of 500 million c.ft., that £14,000 less in gas bills will be paid by the Widnes gas consumers.

While these prices are still substantially above the pre-war prices charged in Widnes—*i.e.*, 1s., 10d., and 8d. per 1000 c.ft., the object of the Gas Committee in recommending the reduction is, after distributing the benefits in a proportionate degree to the small consumers, to offer inducements to the large users of gas for power and industrial purposes that will have such appreciable effect upon their working costs as to be the means, in no small degree, of increasing existing trade and introducing new business, which will in a measure relieve the extreme trade depression that has overcast the town for so long a period.

South Suburban Gas Company's Reduction.—As from the reading of the meters at Christmas, the South Suburban Gas Company announce a reduction in the price of gas of 0 8d. per therm, making the charge 1s. 1·8d.

CONTINENTAL UNION GAS COMPANY, LTD.

The Ordinary General Meeting of the Company was held on Tuesday of last week, at Winchester House, Old Broad Street, E.C.—Col. H. LE ROY-LEWIS, C.B., C.M.G., D.S.O., in the chair.

The SECRETARY (Mr. Edwin C. Bode) read the notice convening the meeting and the Auditors' report.

ILLNESS OF THE DEPUTY-CHAIRMAN.

The CHAIRMAN: Ladies and Gentlemen, before proceeding with the business of the meeting, I regret to say I have received a letter from Lady Lucas informing me that our respected Deputy-Chairman (Sir Arthur Lucas) is laid up with congestion of the lungs. I am sure we are all extremely sorry to miss his presence here to-day, and we all wish him a speedy recovery. I think it may perhaps be for the convenience of the meeting generally if we take the report of the Board as read. [Agreed.]

THE COAL STRIKE AND BETTER CONDITIONS.

The CHAIRMAN: Ladies and Gentlemen, I beg leave to move formally that the report and accounts be received and adopted. In doing so, I should like to make a few remarks on the activities of the Company during the past year, after which I hope that any stockholder who may happen to want additional enlightenment on our affairs, will not hesitate to ask me for it. When I addressed you in December of last year, the country was labouring under the effects of the first coal strike, which had occurred a few weeks previously. Even the most pessimistic of us was not likely to foresee that within a few months another and much more serious strike, covering all the coal-fields in this country, would occur, paralyzing our industries and throwing millions of men and women out of employment. These strikes unfortunately left wide and lasting effects. Through them this country lost entirely—for some time at any rate—its outlets for the exportation of coal, which in pre-war days reached an annual figure of 80 million tons. Happily, the Miners' Unions are at last realizing the disastrous effects of their action, and a better feeling is now prevailing between capital and labour. This is having its effect on prices; and I am glad to be able to report that first-class English gas coal, which a year ago cost 107s. c.i.f. Genoa, is now being freely offered at 37s. We are hopeful that this price will be still further reduced next year. The prospect therefore of this country regaining its lost foreign markets is becoming decidedly better

THE POSITION OF COKE.

Unfortunately, every picture has its dark side; and gas companies, especially those on the Continent, are feeling the very heavy fall in the selling price of coke and other bye-products, which has now been in operation since the early part of this year. Coke, which a year ago was selling freely in Italy at about lire 600 to 750 per ton, and in France at about frs. 200, is now realizing in Italy only lire 200, and in France from frs. 70 to 90 per ton. Even at those prices, it was difficult to sell coke; and the stock amounted in France on the 1st of July of this year to the unprecedented figure of 650,000 tons. Since then, however, coke is selling more freely; and the stock is now diminishing.

EXCHANGE FLUCTUATIONS.

I shall now refer to the fluctuations in exchange which affect so adversely Continental undertakings, more especially those operating in Italy. In that country, the value of the pound sterling varied in 1920 from lire 49·75 to lire 107; the depreciation on 1919 being no less than 51·7 p.ct. The rate prevailing in France varied in 1920 from frs. 40·77 to 68·80 to the pound. So far during the present year, the best rates recorded are, for the French franc 46·10 in July, and for the Italian lire 70 in May. Since then, however, both these currencies have again depreciated; the latest quotation being for the franc 51, and for the lira 90.

AFFAIRS OF THE CONTINENTAL UNION.

Most of my preceding remarks concern more directly the Compagnie l'Union des Gaz, on which, as you are all aware, our own undertaking is mainly dependent; and though I shall return again to the consideration of the affairs of that Company. I should like now to make some remarks on the accounts of the Continental Union, as this year has been a more interesting one than usual. It will be within the recollection of those who were present at our last meeting, that I then indicated that the clouds which had overshadowed us for so long were dispersing. I am happy to be able to tell you to-day that the glimmer of light then apparent has brightened, notwithstanding the many very anxious moments which the Directors have had to face in the past financial year. I will deal first with the profit and loss account. The management and general charges are about £9 less than last year. Do not be alarmed at the increase of £558 in pensions. The explanation will, I venture to think, be most satisfactory to you. You may recollect that, after the disastrous Messina earthquake, this Company was able to settle with the town, and relinquish all connections with that place. There remained, however, a certain number of employees who had to be pensioned off, some of whom have since died. We have been able to come to an arrangement with twenty-five of the survivors, by which they agreed to accept lump sums in commutation of their pensions. This idea has been in our minds for a long time; but, before carrying it out, we waited until the rate of the Italian exchange enabled us to do so at the very low cost of £1273, which in normal times would have exceeded £5000. This annual charge will in future be infinitesimal, as in July last the former Manager, who, owing to his great age, was excluded from the commutation scheme, passed away. There now remain only two small pensions which have not been commuted. I may add that the amount of pensions payable in London will also be appreciably decreased by the death of our former Secretary (Mr. Himing), who retired in 1904. We have had to set aside the large sum of £5038 to provide for taxation, mostly on the final dividend lately received from the Union des Gaz, which, in consequence of war conditions, has been in abeyance since January, 1915. We approached the Commissioners of Income-Tax in the hope that they would admit our contention that the dividend in question should be taxed at 1s. 8d. in the pound—the rate ruling at the time when the dividend was declared, and should have been paid. Unfortunately our claim was not accepted; and we shall probably be assessed at the present rate. A sum of £9000 has been transferred to the contingency fund, to which I shall refer later when dealing with the balance-sheet. Turning to the credit side, the receipt of the belated Union des Gaz dividend accounts for £12,573 of the total credited to dividends and interest. Had this dividend been paid in the normal manner after its declaration, we should have received £29,967. We have thus lost some £17,394 on the difference between the exchange value of the pound in 1915 and in 1921. The income-tax refund has yielded £57 less than in 1920. Sundry receipts are practically the same. Turning to the balance-sheet, the net increase in the sundry creditors and credit balances is due to the provision made for taxes.

THE COMPANY'S INVESTMENTS.

Permit me to draw your attention to the all-important question of our investments. I shall first deal with that part of our holding in the Compagnie l'Union des Gaz which was represented by 7½ p.ct. cumulative preference shares. The Board of that Company, alarmed at the effect the prolongation of the war might have on the finances of the Company by the indefinite piling-up of arrears of cumulative preference dividend, approached us, as holders of 50 p.ct. of the preference shares. They pointed out that, unless the cumulative rights were cancelled, the amount to which the preference shares would eventually be entitled would be so great as to make very problematical any possibility of a distribution ever being made on the ordinary shares. They proposed cancelling all past and future preferential rights in return for a cash certificate of frs. 180 per preference share, payable before any further distribution of dividends could be made. After mature consideration, your Directors agreed to the proposal, which was in due course submitted to, and approved by, the shareholders of the Union des Gaz at the extraordinary general meetings held in Paris in conformity with French law. I am happy to say that in April last the Union des Gaz was able to redeem these cash certificates. This return of capital we have for the time being placed in French Bons de la Defense Nationale, owing to the high rate of exchange, which would render a transfer into sterling so costly.

INVESTMENT DEPRECIATION.

There remains for me to deal with the all important question of depreciation of the investments of our Company, to which reference was made by me at our last meeting. As is stated in the Directors' report, in the present chaotic conditions of affairs abroad, no reliable valuation can be made of our large continental holdings. Their ultimate value must depend on the improvement in economic conditions, which time alone can effect. The depreciation in the shares of the Union des Gaz held by this Company is mainly due to exchange. Will the French exchange ever again recover to its pre-war parity? That is a question which time alone can answer; but I have hopes that the general trend of the French exchange is an improving one.

[The Chairman here drew attention to a diagram which he had prepared showing the fluctuations of the exchange during 1920 and this year. It was seen from this that the peak of the line for last year was very much greater than this year, and that at the termination of the year the distance between the two exchanges was very much more marked. If the average of the curves for the whole year was taken, it would, he remarked, be found on the whole that the 1920 exchange was improved upon. He drew attention to these tendencies because he did not think it was possible for anyone to prophesy what was going to happen to the exchange next year or the year after. Taking a long and broad view, his own opinion was that the exchanges would be materially improved, and to an extent that would place the Company in a better position.]

A BRIGHTER OUTLOOK FOR FRANCE.

France is a wonderfully rich country, and her inhabitants are an economical and industrious race. The recovery of France, to which I referred last year, has been well maintained; and the following considerations on the production of wheat are well worthy of more than passing attention. Before the war, the average surface under corn was 10,800,000 hectares (nearly 27,000,000 acres); and the harvest averaged 90,000,000 cwt. On the other hand, the consumption amounted to 95,000,000 cwt., necessitating the importation of 5,000,000 cwt. During the German occupation, the harvest was reduced to 50,000,000 cwt.; and the amount of imported wheat in recent years amounted to 20,000,000 cwt.—the price paid being from frs. 140 (£2 18s. 4d.) to frs. 150 (£3 2s. 6d) per cwt. This year, notwithstanding the drought, ears are well filled with grain of fine quality, and the farmers are reaping 17 cwt. to 20 cwt. per hectare, as against the usual 15 cwt. It is thus calculated that the harvest this year will produce 80,000,000 cwt. Although pre-war conditions have not yet been restored, farmers are well satisfied with their prospects, the brightness of which is in large measure due to the energy and courage with which the peasantry have recultivated the battlefields of Northern France. If we turn to the consideration of the foreign trade of France, there is also room for hope. Statistics issued by the Customs Authorities compared the exports and imports of France for the first eight months of the present year with those of the corresponding period of last year. They show that imports from Jan. 1 to August 31 this year amounted to frs. 13,607,849,000 (£272,156,980), as against frs. 34,342,777,000 (£686,855,540) in the same period of 1920—a decline of frs. 20,734,928,000 (£414,698,560); while exports amounted to frs. 14,086,002,000 (£281,720,000), as compared with frs. 17,234,654,000 (£344,693,000)—a reduction of frs. 3,148,632,000 (£62,973,000). The volume of foreign trade, it is true, has fallen heavily, largely owing to the reduction in prices, but the balance of exports as compared with imports is this year largely in favour of France, although in the first eight months of this year the value of French exports was frs. 3,148,000,000 (£62,960,000) less than in the corresponding period of last year. She has also reduced her liability for imports to the extent of frs. 20,000,000,000 (£400,000,000). Thus France's purchases in the

first eight months of last year exceeded by frs. 17,000,000 (£340,000) the amount of sales to foreign countries, whereas in the first eight months of the present year the sales exceed purchases by frs. 478,000,000 (£9,560,000). This is a magnificent result unhoped-for in the present condition of the commercial world, and not thought possible a few months ago.

SHARES IN FOREIGN GAS COMPANIES.

There may, of course, be little or no hope of the French exchange righting itself again (though that is not my opinion); but if that should unfortunately be the case, we should be bound then to deal with the shares which we hold in foreign gas companies, either by writing-down or by reducing our capital. In my opinion, the consideration of such measures as these is premature, and we should be well advised to possess our souls in patience until we are out of the present uncertain state of affairs. As regards the Company's general investments and its English gas holdings, the Board decided to allocate the amounts credited to the contingency fund to the writing-down of these investments to the value at which they were quoted on June 30 last. I am sure that this decision will meet with your approval.

A PREFERENCE DIVIDEND.

Earlier in my speech, I referred to the dawn of better times. As evidence of this, the Directors are able to recommend that out of the available profits a dividend be distributed on Jan. 3 next of 3 p.ct. on the preference stock, less tax. This will absorb £4200, and leave £1956 to be carried forward.

WORKING OF THE UNION DES GAZ.

In the earlier part of my speech, I touched on matters such as exchange and prices of coal which more directly refer to the Compagnie l'Union des Gaz. As at our last general meeting I explained in detail the constitution of that Company and its field of operation, it is needless for me to refer again to these points. That Company's accounts for the financial year ending June 30 last not having been issued, I am unable to deal as fully as I should have liked with the results of the year's activities. From details supplied me from the head office in Paris, I understand that for the year under review the gas sales at their stations decreased during the whole year by 6½ p.ct. Considering the bad condition of business generally on the Continent, I had expected a larger falling-off. The depreciation in the selling price of bye-products on the Continent, more especially of coke, to which I referred earlier in my speech, has severely affected that Company's receipts, diminishing them by no less than 7½ million francs. The total paid during the year for salaries and wages at the works was about frs. 14,000,000—being an increase of frs. 4,500,000 over the previous year. Of this increase, over frs. 2,500,000 is attributed to the actual cost of gas manufacture. With a decrease in the cost of living, wages will fall. The working population cannot continue to be misled by the fallacies of their extremist leaders. They must come to realize that wages can only be paid out of the proceeds of production ["Hear, hear"], and that the real interest of capital and labour is to work in complete harmony.

BAD RETURNS FROM GENOA.

The Paris Board fear that, when the final accounts are got out, the results will show a serious loss on the year's working, mainly due to the bad returns from Genoa. Last year I referred to this station as being the very black point on the horizon, and informed you that arduous and difficult negotiations with the town authorities were then going on. It was soon after then that these negotiations were in some degree successful, enabling the prices of gas to be increased—only sufficiently, however, to minimize the monthly losses that were being actually sustained, and making no provision for war losses. As the municipal authorities refused to agree to terms which would have enabled the Union des Gaz to recoup its war and after-war losses, that Company had no alternative but to appeal to the Commission at Rome to grant a cancellation of the concession. The Commission having lately rejected the Company's appeal, the whole question has been again submitted to the Company's legal representatives in Italy, by whom the Union des Gaz Board will be guided as to further steps to be taken to defend the Company's interests. The loss on the working of the Genoa station is responsible for some lire 12,000,000 in the last financial year alone, and yet when the Union des Gaz appeals to the Italian authorities for some relief from this intolerable burden justice is denied to it. Such an attitude was not to be expected from a country which owes us some £400,000,000; and I should feel no surprise to hear that the British Government viewed with some anxiety the method of procedure adopted by the Italian authorities, when they are dealing with British capital invested in public works in Italy.

BETTER TREATMENT IN FRANCE.

In France, the Union des Gaz is meeting with much better treatment. Gas prices have been increased to a remunerative level; and negotiations are pending with several of the Municipalities, by which it is hoped good workable contracts will be arrived at. The Union des Gaz activities are not limited to the supply of gas. In four of their towns in France, they are now producing electricity; and I am happy to say that the returns last year have been most satisfactory. On June 30 last, the number of consumers of electricity on their books was 9616; being an increase in the year of over 3300. I am hopeful as to the future of the Union des Gaz. I believe that at last the clouds are lifting. Like so many continental gas companies, it has since 1914, owing to war conditions, been unable to distribute any dividend. But do not forget that, although it had to avail itself of the moratorium as regards the redemption of its bonds, the repayments have now been resumed, and all arrears are being rapidly wiped off. It was always able to meet its annual debenture interest charges, and some months ago to pay the outstanding 1914 final dividend.

THE ACCOMPLISHMENTS OF RESTORATION.

Ladies and Gentlemen, if I am hopeful as regards the Union des Gaz, still more am I so as to the future of France. Latterly, I have had occasion to visit its war-devastated Eastern provinces. I have been struck with the wonderful changes, almost unbelievable, effected there since my official visit shortly after the conclusion of peace. There are few unemployed, and generally all are working well. The prosperity of the Continental Union is intimately connected with that of the Union des Gaz, and the well-being of that Company is indissolubly linked with the welfare of France. I know that country fairly well; and I have faith in it. I regret more than I can tell you the policy of pinpricks and ill-will which seems to govern some of our publicists with reference to France; and I have always noticed that those people who are most bitter are they who know least about the matter, Could these loud voiced disturbers of the peace realize that France is only desirous of a reasonable degree of security for her frontiers, and that she is really devoted to the cause of peace, our relations with our ally would be considerably more cordial than they are at present. In one of my last journeys in France, I crossed a part of that wasted region, which extends for about 200 miles in length by 40 miles in breadth from the North Sea to Alsace, and I was astonished to see that, though the reconstruction of the towns was not making as rapid headway as might be desired, yet the soil in that terrible inferno we used to call "No-Man's Land," was now actually under crops. That marvellous result has been achieved by the indomitable fortitude and industry of the French peasant. It is to him that we must look to rehabilitate France; and I am convinced that we shall not look in vain. I now beg leave to move that the report and accounts be received and adopted.

Sir GEORGE TOUCHE, Bart., seconded the motion, which, he remarked, had been proposed in such an admirable and statesmanlike speech by their Chairman. He was glad to be associated with the adoption of a report which marked the return—even if only a somewhat small and modest return—into the dividend-paying list, especially at a time when so many companies were either reducing their dividends or passing them altogether. He thought it right to say that the better prospects before the Company were largely due to the unwearied efforts of their Chairman, who was constantly travelling by land, sea, and air in order that he might watch over the Company's continental interests, which, as the proprietors knew, were very large and very important, and which, as they would have gathered from what the Chairman had said that day, were involved in some very difficult questions, which he did not think anyone was better able to handle than their Chairman.

THE PREFERENCE DIVIDEND AND THE DIRECTORS' FEES.

Mr. E. WOOLLEY said he should like to say that, in common with a few other proprietors, he felt a little inclined to grumble. In considering the position of the preference stockholders, although he was also an ordinary stockholder himself, he thought perhaps it would have been a little better if their immediate interests had been taken into account in the matter of income. Having said this he did not propose to carry it any further. It was no doubt a matter of prudence to put £9000 to the depreciation of the investments. The continental ones they could not touch at present, so this was as far as that went just now. He was glad the Chairman had put the case of France so very plainly and truly. He was in Belgium last summer; and he took the opportunity of going through the war area there and in France. He bore testimony to the great industry that he found throughout those areas.

Sir JAMES REMNANT, Bart., M.P., congratulated the Chairman upon the excellent speech he had made. There was one recommendation he should like to offer; and he was sure it would be agreed to by every lady and gentleman on his side of the table. While congratulating the Board upon what they had done, the stockholders should look upon the rather material point as to what the Directors were drawing in the shape of fees. He had looked into the Articles of Association, and found the Directors were entitled to draw £2500 a year; but since 1915 they had only drawn £750, having given up the remainder of their own accord. He did not think the stockholders knew how much the Directors had voluntarily relinquished of their own free will; and they should show their appreciation of this to-day. In his opinion, the Directors should get their £750 tax free, because, if they considered the £750 less income-tax or super-tax, it left only about £60 for each Director for the work done. It was ridiculous for them to expect their Directors to receive only that sum. [Hear, hear.]

The CHAIRMAN said he should like to say with reference to Mr. Woolley's remarks, that he entirely sympathized with him about what he said as to the preference dividends; but the Board were actuated by the hope of being in a position of not letting down the preference holders next year; and perhaps it would be possible even to increase the dividend a little bit if things were prosperous. The stockholders might depend upon it that the larger the dividend declared, the better pleased he should be as a holder of ordinary stock. As to the remarks of Sir James Remnant, he did not think it was necessary to have any resolution at all on the subject. It was entirely within the competence of the Directors to decide for themselves how much they should receive of the £2500 to which they were entitled by the Articles of Association. The Board felt it only right, while their stockholders were not enjoying dividends, they should subsist on meagre fees. They therefore reduced their fees to £750. Taxation had increased enormously lately; and most of them had to pay 10s. to 12s. in income-tax and super-tax; so that the £750 had dwindled down to about £375, which made a poor showing. If it was the wish of the proprietors that the Board should enjoy the fees tax-free, he thought the Board would graciously yield to it. [Hear, hear.] But he did not think the Board would be prepared to take more in fees than they had already voted until the prosperity of the Company was more completely restored.

The motion approving that the Directors fees for the financial year under review be paid free of income and super tax was unanimously carried.

RE-ELECTION OF DIRECTORS AND AUDITORS.

Moved by the CHAIRMAN, and seconded by Sir HENRY BIRCHENOUGH, Bart., K.C.M.G., the retiring Directors (Sir G. A. Touche, Bart., and the Right Hon. Sir Edward A. Goulding, Bart., M.P.) were unanimously re-elected.

Both Directors having acknowledged the confidence of the proprietors,

Mr. JAMES H. SOLOMON proposed, and Sir JAMES REMNANT seconded, the re-election of the Auditors (Messrs. C. P. Crookenden and G. A. Cave-Orme), at a remuneration of 100 guineas per annum.

VOTES OF THANKS.

The CHAIRMAN moved that the thanks of the meeting be accorded to the staff at home and abroad. He said their small staff in London worked extremely well, and were devoted to the interest of the stockholders. In their Secretary (Mr. Bode), who had been in the service of the Company 46 years, they had a servant, although he might at times keep him (the Chairman) in order, who was devoted to the Company's service, in which he was always ready to sacrifice his time, energy, and even his health. The other members of the staff were untiring in their efforts; and the Company could not be better served.

Mr. WOOLLEY seconded the motion, which was cordially agreed to.

Mr. BODE, on behalf of the staff at home and abroad, thanked the proprietors most heartily for the vote. He felt that any effort he could make for the Company was a pleasure, more so when one served under such chiefs as those around him. No body of stockholders had a Board more loyal or devoted to the interests of the concern than those of the Continental Union Gas Company.

On the motion of Mr. WOOLLEY, seconded by Mr. H. F. GRIMSTONE, a cordial vote of thanks was passed to the Chairman and Directors.

GOTHIC WORKS WAR MEMORIAL.

The Rt. Hon. T. M'Kinnon Wood (Chairman) unveiled last Saturday week, at the Gothic Works, Edmonton, the war memorial erected to perpetuate the memory of the 52 employees of Messrs. Glover and Main, Ltd., who fell in the war. The memorial has taken the form of an old Gothic chantry or shrine of oak and red brickwork, mounted on a two-step foundation of red bricks. The design is a free rendering of Tudor Gothic "Perpendicular" style, which has been employed over the main front, with mullions running from the top to the bottom of the openings. The back wall, built of red bricks, supports the bronze tablet, 3 ft. by 3 ft., with the names of the fallen in relief letters.

Directors, members of the staff, relatives of the fallen, and about 700 employees, assembled in the works hall, where the first portion of the ceremony took place. The proceedings commenced with a rendering of "Land of Hope and Glory" by the Gothic Works Military Band; the audience joining in the refrain.

The CHAIRMAN, in addressing the gathering, said: We have met here this morning to do honour to the memory of a gallant band of men—associates of ours, near friends and close relatives of some of us. They were called from their peaceful labours here to do a great service, and to make a great sacrifice. I believe that, in the early days of the war, a very large proportion of our men voluntarily offered their youth and their lives for a cause which they believed, and which we believed, to be a sacred cause. One of the leaders of these early volunteers was a man whom we held in high esteem and affection, whose loss in the rich promise of early manhood we all deeply deplored—Captain Richard Glover. Another of the leaders of these men is happily still with us—your present chief, Colonel William Glover, who passed with distinction through the war from the first day to the last, bearing the heavy strain of positions of great responsibility, and passing through its constant and daily dangers happily unscathed. I think we ought to remember our debt of gratitude to those who served and survived, as well as to those who served and fell.

But it is of these last that we are thinking to-day. These men fought to preserve our freedom. They counted their lives as nought. These memorials have two aspects. They remind us of the past; and they point to the future. I suppose all of us who have lived many years in the world, and even some who have lived but a few years, have black days, the recollection of which is deeply graven on our memories as with a tool of steel. One of these days in my life was that solemn Sunday, Aug. 2, 1914, when the British Government—of which I was then a member—were sadly deliberating as to what was their duty to the nation in the crisis which had been forced upon them, despite their most earnest efforts to preserve the peace of Europe. They did not come to their decision, I assure you, lightheartedly or thoughtlessly, without having counted the cost, which they well knew would be a heavy one. But they saw no alternative to throwing in the power of this nation on the side of freedom. Though seven years have elapsed since that day, I think the great mass of the people of this country have never faltered in the belief that there was no alternative. The cost has been heavy indeed; and we are bearing it now. Europe will be impoverished by the war for long years to come.

Well, what does this memorial stand for? We have had three years since the armistice of profound disappointment and disillusion. The war does not appear to have ended wars. But there are some bright streaks of promise in the sky. I trust that we see the end of that quarrel with Ireland which has lasted for centuries, and which has been a constant source of weakness to this country. There are good tidings from the great conference at Washington. And we have some reason to hope that, by limitation of armaments, we shall reduce that intolerable burden of taxation which is pressing to the ground the industries of Europe. But we have a great deal to do before we accomplish the task for which these men died. As I have said to you, these war memorials remind us of the past; and by the example of the good men and true whose names they commemorate, they point us to the future. What we have got to do is to finish the work for which these men fought, and for which they died. What was that? It was to make this dear country of ours free and happy. To preserve its freedom and its happiness we want to see a restoration, so that there may be no difficulty in any willing man finding work—and well-paid work—to do. We have a great deal to do to accomplish that.

I always think that these memorials stand plainly for one thing; and that is unity. If you look at them in any part of the country, they always contain the names of men of every profession and calling, of every class and rank. These men understood that what was necessary for victory, to save the freedom of the country, was absolute unity—a universal and undivided effort by the whole nation. Believe me, unity and undivided effort are as necessary now for the restoration of our country as it was to obtain victory; and I cannot help thinking that the best tribute to the memory of these men is to complete their work, so that they will not have died in vain, and that the example of their lives and the glory of their death will live after them—an enduring memory to us, to our children, and to generations after them.

At the conclusion of the Chairman's speech, the Doxology was sung. Members of the audience then took up their position in front of the memorial; and the Chairman unveiled the beautiful bronze plate containing the names of the fallen—the band playing the National Anthem. Mr. Brown, the oldest employee, who has been in the service of the firm for 64 years, laid a large laurel wreath at the foot of the plate; and the relatives of the fallen also placed their offerings of flowers beside it.

RADCLIFFE GAS-WORKS INSPECTION.

The Radcliffe (Lancs.) Gas-Works, which supply a very large industrial area, recently became a municipal concern, with the Radcliffe and Little Lever Councils as joint partners. Since the purchase from the private Company, the works have been modernized by the installation of vertical retorts by Messrs. Drakes, Ltd., of Halifax; and the contrast between the old and the new principles of gas manufacture greatly impressed the members of the two authorities when they held their official inspection of the works on Dec. 10.

The company were taken through in groups, led by Messrs. R. B. Braddock (the Manager), J. Melling, J. Susbe, and J. Nicholl (heads of Departments); and Mr. Thompson (Messrs. Drakes' representative) gave valuable supplementary information.

The new plant consists of five settings, each containing eight vertical retorts capable of carbonizing 2½ tons of coal each per twenty-four hours; the retorts being heated by patent settings. The visitors saw how labour is saved by the automatic appliances and other modern methods of dealing with the coal on delivery. The receiving hoppers for the coal are arranged over the retorts, from which the coal gravitates through valves and feeding appliances into the retorts, where the gas, tar, and oils are driven-off by the application of external heat. The coke is air-cooled; leaving a fuel free from moisture. It is extracted and passed into bogies; having gone through the whole process of carbonization without being touched by hand. All the coal-handling plant is electrically driven, and the coke extractors are worked by small steam-engines, which run continuously. The whole of the new plant has been designed and erected in accordance with Mr. Braddock's instructions.

Figures officially quoted from the result of a few months' working of the new plant revealed very satisfactory results; more gas being turned-out at less cost and of a superior quality. During October 24,509,009 c.ft. of gas was made from 1841 tons of coal, or 13,204 c.ft. per ton; whereas in the same month of 1920 the respective figures were 21,557,000, 1800, and 11,773.

When the municipalization of the works was first suggested, two townships in the area refused to join the scheme (Prestwich and Whitefield), the working-men ratepayers of which would not put into practice the policy of public control of essential industries. It was urged during the controversy that gas was a played-out power. These pessimistic prophecies were met during the visit by the announcement that already the new Board were selling 13 p.ct. more gas than did the private Company when trade was good. Moreover, 75 p.ct. of the shareholders of the old Company have indicated their confidence in the municipal venture by leaving their financial interest in it in the form of loans.

After the company had had tea together, representatives of the two Councils expressed their complete satisfaction with what they had seen; and mild fun was indulged in at the expense of those who had spoken adversely of the works and of gas generally. It was hinted that as Radcliffe and Little Lever had come together in a Gas Board, it might lead to the townships becoming one and forming a borough.

ILLUMINATING GLASSWARE.

In addition to the inquiries before a Referee, under Part I of the Safeguarding of Industries Act, as in the case of gas-mantles (reported in the "JOURNAL" last week), there are also inquiries taking place under Part II. Whereas under Part I complaints are made as to the improper inclusion in, or exclusion from, the list published by the Board of Trade, to give effect to the schedule which specifies the goods chargeable with duty, the object of the enquiries under Part II is the prevention of dumping. Of course, applications may be made under both sections in respect of the same article. Indeed, we understand that steps are being taken by the British gas-mantle manufacturers to bring a complaint under Part II, with the object of preventing the dumping of gas-mantles into this country. Under the prevention of dumping section, inquiries are not heard by a Referee, but by a Committee appointed by the Board of Trade—a panel of members having been selected, from which Committees are appointed from time to time.

A complaint is brought before a Committee if the Board of Trade considers that a *primâ facie* case has been made out that certain goods are being sold or offered for sale in the United Kingdom, (*a*) at prices below the cost of production, or (*b*) at prices which, by reason of depreciation in the value in relation to sterling of the currency of the country in which the goods are manufactured (not being a country within His Majesty's Dominions) are below the prices at which similar goods can be profitably manufactured in the United Kingdom, and that by reason thereof, employment in any industry in the United Kingdom is being, or is likely to be, seriously affected. The Board of Trade may not refer the matter to a Committee so far as depreciation

of currency is concerned, unless they are satisfied that the value of the currency of the country in question in relation to sterling is less by 33⅓ p.ct. or upwards than the par value of exchange. Committees appointed by the Board under this section are to report also on the effect which the imposition of a duty under this part of the Act would exert on employment in any other industry using the goods in question.

One of the first applications under this part of the Act related to domestic and illuminating glassware; and the complaint was lodged by the British Flint Glass Manufacturers' Association and the National Flint Glass Makers' Society. Originally, the complaint related to Germany, Czecho-Slovakia, and Belgium; but when the Committee commenced its sittings on the 12th inst. it was announced that the Board of Trade had decided that a *primâ facie* case had not been made out with regard to Belgium. At the same time, the complainants withdrew their complaint as to mounting glass, which was included in the original complaint. Thus the Committee, which consists of Sir William Ashley, Sir T. W. Allen, Sir John Barran, Mr. F. R. Davenport, and Mr. Aiton, is considering only the complaint as to domestic and illuminating glassware. The Committee heard evidence in public on Monday of last week, and in the evening went into a private sitting on the question of manufacturers' costs and profits. It met again on Dec. 13, and then adjourned, so far as the hearing of evidence in public is concerned, until Dec. 20. There has, however, we understand, been at least one private sitting in the meantime.

For the moment, the Committee is considering mainly domestic glassware, and special evidence is to be put before them with regard to illuminating glassware. There have been a number of references to the latter matter; and we to-day report a few items of interest in connection with glassware used for gas-lighting purposes. Generally, the evidence has been that in both branches under consideration, glassware is coming into this country from Germany and Czecho-Slovakia, and is being sold at a price which approximates to our labour costs here. Out of 1200 members of the glass makers' union, no fewer than 564 are now totally unemployed; and a great majority of the remainder are said to be working, some three days a week, and some three days a fortnight. It is admitted that a 33⅓ p.ct. tariff would not completely eliminate the disastrous effects of foreign competition, the strength of which is admitted to be due to the state of the exchange. But it is urged that such a tariff, in conjunction with the general improvement of conditions here in the direction of reduced labour and material costs, would place the industry in such a position that the majority at least of the at present idle furnaces, and in some cases closed works, could begin operations again.

The most direct references to illuminating glassware for gas purposes were made during the hearing of the evidence of Major W. L. Foster (a Managing Director), Mr. W. L. Chance (a Director), and Mr. A. E. Bassett (the Sales Manager) of Messrs. Chance, Bros., & Co., of Smethwick. It had previously been explained that heat-resisting glass had not been made in this country before the war; and its production was commenced during the war owing to the total cessation of supplies in 1914, and in consequence of pressure brought to bear upon manufacturers of other glass by the Glassware Department of the Ministry of Munitions. Incidentally it may be mentioned that Sir Arthur Colefax, K.C., who was chief of the Glassware Department of the Ministry during the war, and sent the Manufacturers' Association a letter of thanks for the way in which they had met the demand, is present at the inquiry in opposition to the application on behalf of the China and Glassware Section of the London Chamber of Commerce. Counsel are permitted, under the rules formulated by the Board of Trade, to address the Committee on behalf of persons appearing before it; but witnesses can only be questioned by the Committee, and no cross-examination by Counsel is allowed.

Major Foster, in his evidence, said that in 1914 the gas companies and lamp manufacturers had approached the Board of Trade with a view to get the Government to induce English glass firms to produce heat-resisting glass, and subsequently his firm received a letter from the South Metropolitan Gas Company, who were very large users of this glass, pointing out how seriously the gas lighting industry would be prejudiced were supplies of this material not obtainable. The Company also stated that the goods produced by Messrs. Chance were highly satisfactory.

Mr. Bassett later said that the South Metropolitan Gas Company obtained all their supplies from Messrs. Chance, and quoted from a letter received from the Company giving costs of replacements per lamp. For the six months ending June, 1913, when German heat-resisting glass was used, the average replacements per lamp were 2·27; for the six months ending June, 1920, using Messrs. Chance's glass, the figure was 0·64.

Sir Thomas W. Allen (a member of the Committee) pointed out that it had been said that the rate of importation into the country of this particular form of glass was only 50 p.ct. of the pre-war amount, and if this were so, there must still be a large market. To this Mr. Bassett replied that he imagined the market had gone down by about 50 p.ct. One of the main factors in regard to this was the increasing use of electricity—the gas industry, in this respect, was a declining industry.

This is all that has been said with regard to illuminating glassware, as far as it affects the gas industry. As already intimated, special evidence is to be given on this aspect of the inquiry.

Irish Towns Unlighted.—Wexford and Enniscorthy remain unlighted, much to the inconvenience of the ratepayers. In the latter town, this condition arises on the decision of the Urban Council to effect retrenchment. But it has been pointed out that the absence of public gas lighting is not desirable, even in the interests of economy. At a Wexford Corporation meeting, Mr. Byrne made strong complaint of the want of light, for which, he said, £400 had been allocated. Alderman Connolly urged that they did not want to squander money on a new contract with the Gas Company at an excessive charge. The Company asked as much for six weeks' service as for a whole lighting season. The Mayor (Alderman Corish) thought they were justified in asking the public to wait until January, when they would have electric lighting. A proposal that gas lighting should be resumed meanwhile was not accepted.

THE WAGON ASSOCIATION.

Arising out of a meeting of private wagon owners held last October at the Cannon Street Hotel, details for the formation of a Wagon Association have been drawn-up and sent as a circular to private wagon owners, colliery companies, and coalowners, by the Acting Secretary (Mr. Edwin A. Hart, of Nos. 11 and 12, Coal Exchange, E.C.)

The objects for which the Association is to be formed are (A) Protection (including combined action regarding repairs), and (B) Inspection.

PROTECTION.

(1) To protect the interests of private wagon owners generally.

(2) To advise members on all matters relative to wagons.

(3) To watch the interests of wagon owners, especially in relation to parliamentary and other matters.

(4) To closely watch and keep in touch with Government Departments, the railway clearing house, and the railway companies, as regards regulations relative to wagons—*e.g.*, alterations in specification, standardization of wagons, railway rates, haulage, &c., and more especially to follow closely the attitude of the railway companies as regards private wagon owners.

(5) To obtain preferential terms for its members by collective bargaining with repairing firms, for which purpose a very complete schedule of repair charges will be drawn-up and agreed with repairing firms as a maximum. This schedule, the prices of which will be revised as necessity arises, will be issued to members, together with a list of repairing firms agreeing, and each member to be at liberty to negotiate direct with any firm or firms on the list.

INSPECTION.

To inspect members' wagons while under repairs, and to expedite repairs where there is unnecessary delay, for which purposes competent inspectors would be stationed in various areas.

SUBSCRIPTION.

For all benefits except inspection. This would be a graduated one—

	10s. 6d.	per annum for	owners of	10	wagons.
£1	1s. 0d.	,,	,,	25	,,
£2	2s. 0d.	,,	,,	50	,,
£5	5s. 0d.	,,	,,	100	,,
£7	7s. 0d.	,,	,,	200	,,
£10	10s. 0d.	,,	over	200	,,

This subscription has been made as low as possible, so that all wagon owners may join, including those doing the bulk of their repairs.

To place the Association on a workable and sound financial basis, it is estimated that an income of at least £5000 per annum should be secured.

SULPHATE OF AMMONIA PRICES, SEASON 1921-22.

The British Sulphate of Ammonia Federation, Ltd., announce their prices for spring delivery, which, it is pointed out, are considerably lower than prices now being obtained for export, and will apply subject to supplies being available when the order is received. The right is reserved to alter prices at any time without notice; but prices under contracts made in accordance with these terms and conditions will not, of course, be affected by any subsequent alteration in prices.

The Federation offer to sell sulphate of ammonia for home agricultural use at the following prices:

For January delivery, 1922.

£16 3s. per ton for neutral quality in fine friable condition, free from lumps, containing 25¾ p.ct. ammonia; or
£15 per ton for ordinary quality containing 25¼ p.ct. ammonia.

For February delivery, 1922.

£16 13s. per ton for neutral quality as described above.
£15 10s. per ton for ordinary quality as described above.

For March-April-May delivery, 1922.

£17 3s. per ton for neutral quality as described above.
£16 per ton for ordinary quality as described above.

Delivered to consumer's nearest station or wharf in Great Britain, for prompt cash payment, in lots of 4 tons and upwards.

Neutral sulphate of ammonia as described above, guaranteed not to contain more than 0·25 p.ct. free acid, will be sold on the basis of 25¾ p.ct. ammonia, with no charge if over 25¾ p.ct., but with an allowance per ton of—

3s.	if the content of ammonia is under				25¾	p.ct.,	but not under		25¼	p.ct.
6s.	,,	,,	,,	,,	25½	,,	,,		25¼	,,
9s.	,,	,,	,,	,,	25¼	,,	,,		25	,,
12s.	,,	,,	,,	,,	25	,,	,,		24¾	,,

A further allowance of 9s. 6d. per ton will be made should the content of free acid exceed ·025 p.ct., and an allowance of 9s. 6d. per ton will also be made, should any delivery of neutral sulphate not be in fine friable condition, free from lumps.

Ordinary sulphate of ammonia will be sold on the basis of 25¼ p.ct. ammonia, with no charge if over 25¼ p.ct., but with an allowance per ton of—

3s.	if the content of ammonia is under				25¼	p.ct.,	but not under		25	p.ct.
6s.	,,	,,	,,	,,	25	,,	,,		24¾	,,
9s.	,,	,,	,,	,,	24¾	,,	,,		24½	,,
13s.	,,	,,	,,	,,	24½	,,	,,		24¼	,,
19s.	,,	,,	,,	,,	24¼	,,	,,		24	,,
26s.	,,	,,	,,	,,	24	,,	,,		23¾	,,

If ordinary sulphate is ground, pulverized, or otherwise rendered free from lumps at buyers' request, an additional charge of 7s. 6d. per ton will be made.

The above qualitative increase and deductions apply only to deliveries of 2 cwt. and over.

The above prices are delivered free in 4 ton lots and upwards to buyer's or consumer's nearest railway station or wharf in Great

Britain (or f.o.b. British port, when the ultimate destination is the Isle of Man); and packed in single bags containing about 2 cwt. net to be supplied free by sellers, tare allowed. The maker will allow 10s. per ton if the buyer elects to take delivery by road vehicle *ex* works. When credit is given, a reasonable extra charge may be made; but the discount allowed for prompt payment should be quoted on the invoice.

For deliveries of less than 4 tons, the following extra charges will be made:

2 tons and over, but less than 4 tons, 5s. per ton over 4 ton price.							
1	,,	,,	,,	2 tons, 10s.	,,	,,	,,
2 cwt.	,,	,,	,,	1 ton, 1s. per cwt.	,,	,,	
1 cwt.	,,	,,	,,	2 cwt., 2s.	,,	,,	,,
28 lbs.	,,	,,	,,	1 cwt., 3s.	,,	,,	,,
14 lbs.	,,	,,	,,	28 lbs., 4s.	,,	,,	,,

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 20.

There is practically nothing fresh to report in the London market. Pitch is steady at the last figure mentioned; and generally there is no change in the prices of other products.

Tar Products in the Provinces.

LONDON, *Dec.* 19.

The average values for gas-works products during last week were: Gas-works coal tar, 43s. 6d. to 47s. 6d. Pitch, East Coast, 47s. 6d. to 50s.; West Coast—Manchester, 40s. to 45s.; Liverpool, 40s. to 45s.; Clyde, 40s. to 45s. Benzole 90 p.ct. North, 2s. 4d. to 2s. 6d.; crude 65 p.ct. at 120° C., 1s. 11d. to 2s. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluole, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11d. to 11¼d. Solvent naphtha, naked, North, 2s. 8d. to 2s. 9d. Heavy naphtha. North, 2s. 7d. to 2s. 9d. Creosote, in bulk, North, liquid, 6d. to 6½d.; salty, 5⅜d. to 6½d. Heavy oils, in bulk, North, 9d. to 9¼d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £15 to £20; salts, £6 to £7, bags included. Anthracene, "A" quality, 8d. to 10d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

There seems to be a better demand for a few coal-tar products for immediate delivery; the reason being probably that, in view of the coming holidays and the end of the year, many contractors need to cover their commitments. The market for pitch remains very uncertain and irregular; and it is difficult to get any reliable quotations. From Manchester it is reported that pitch has been sold at under 30s. per ton. On the other hand, 50s. per ton is mentioned. It is difficult to believe the first statement, since there is considerable scarcity of tar and no reason whatever for the sacrifice of pitch at that price. Solvent naphtha appears to have fallen away again. Makers are asking 2s. 9d. to 3s. per gallon; but in some quarters it is suggested that 2s. 6d. would be accepted. The actual output of this material is small, and considerable risk would be involved in "bearing" the market, owing to the fact that there is no present prospect of starting-up the coke-ovens, since blast-furnaces cannot be got into operation. Creosote is in fairly good demand for immediate delivery at about 6½d. per gallon; but considerable uncertainty has developed in the forward position, and probably not more than 5½d. is the utmost value for delivery in the first few months of next year. Carbolic acid is a dead market; but it is probable that if we have lower prices for creosote it may be worth while to extract the carbolic acid for sale at a price at which manufacturers of crystals can buy. Present values remain in the neighbourhood of 1s. 6d. per gallon for crude, and 5d. per lb. for crystals. Cresylic acid is only in poor demand; pale being worth 2s. 2d. per gallon and dark 1s. 10d. Naphthalenes are in poor demand, with very little doing—crudes at £5 10s. per ton and refined from £14 10s. to £18. Benzole is scarce, and is readily sold on the market; prices ranging from 3s. 4d. to 3s. 6d. per gallon. Business in intermediate products has continued fair; but there are a few signs that an early improvement may be expected. There are more inquiries, and buyers are more inclined to do business than of late. There is no change in quotations.

Sulphate of Ammonia.

Although we are rapidly approaching the season when sulphate of ammonia is most called for, there is not much indication of any large amount of business passing in this material, except for export. Particulars of the November trade for Great Britain, however, reveal that during last month there was a further decline in the total amount exported—only 7408 tons leaving the country, as compared with 11,558 tons in October, and 13,186 tons in November last year. Altogether the exports for sulphate for the first eleven months of this year amounted to 116,115 tons, valued at £2,475,119, as compared with 295,920 tons, valued at £4,031,918, for the same period in 1913. During November, Spain and the Canaries and France took about 1750 tons each. This makes the total exports to France 27,358 tons so far this year, and to Spain and the Canaries 36,560 tons. Japan comes next with 856 tons, against 500 tons in October and over 10,000 tons in November, 1913. Reports from America suggest that Japan—our best pre-war customer—is operating in the American market. The position in France is that of comparative scarcity; and this country is likely to draw upon the English market even more in the early days of the New Year than she has done in the past.

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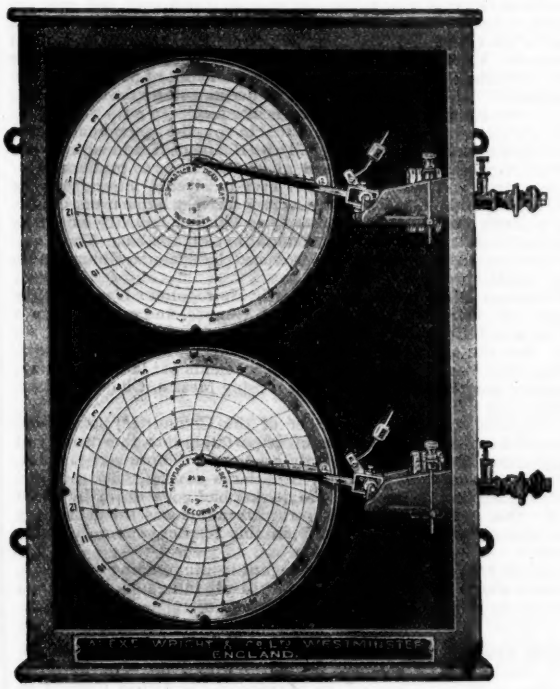

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Co-Partnership at Redhill.

The eighth annual report of the co-partnership scheme in connection with the Redhill Gas Company, which was submitted at the annual meeting of co-partners, stated that the Directors had been pleased, without reference to the price of gas (which precluded the declaration of a bonus under the rules), to maintain the distribution at the former rate of 2 p.ct., amounting for the past year to £275. The number of employees on the co-partnership register at June 30 was 74; and the amount of ordinary "B" stock registered in the names of co-partners at that date was £950, while £500 had been purchased subsequently. The Chairman (Mr. G. R. Hunt), referring to the joining-up of the Redhill and Reigate undertakings, said that those men who were permanently employed in the Reigate concern, and who were recommended for co-partnership by the officers of the Company, had been made co-partners; and their agreements dated back to the day on which Redhill took possession of the Reigate undertaking. Directly they received the necessary authority, the Directors set about revising the co-partnership rules, and altering them so that the scheme would be of much greater benefit to the co-partners themselves. In this matter they were very much indebted to their Managing-Director (Mr. W. H. Bennett). It was explained by Mr. Bennett that in the past the bonus was directly based upon the price of gas. In the light of war conditions, this was found to have a defect; for when the price of gas rose beyond a certain figure, the bonus, under the scale, entirely disappeared. They had now altered the rule so that the bonus would be at the same rate as the dividend paid to holders of ordinary "B" stock in the Company for the preceding year. The Directors had found it necessary to alter the rules so that, after the co-partner owned £10 of stock, three-quarters (instead of one-half) of the bonus would be placed to investment account, and one-quarter (instead of one-half) would be available for withdrawal. Under the new rules, the co-partner could withdraw anything standing to his credit in the withdrawable account without restriction. For the present the Board had decided that they would give 5 p.ct., instead of 4 p.ct., interest on money in the hands of the trustees.

Further Reduction at Yarmouth.—The Great Yarmouth Gas Company are in a position to intimate that, from and after the reading of the meters for the current quarter, the price of gas to all classes of consumers will be further reduced by 1½d. per therm, making, with the reduction already announced for the current quarter, a total reduction equal to 1s. per 1000 c.ft. The new prices will be 1s. 4¾d. per therm for ordinary consumers, and 1s. 0½d. for power purposes. In the case of prepayment consumers, the meters will not be altered to give the increased quantity of gas equivalent to the further reduction in price, as the Directors hope to be in a position to make further concessions at an early date; but the consumer will receive at the time of collection a rebate in cash at the rate of 1s. per 1000 c.ft. on the amount due for gas consumed at the old rate of charge.

Price Reduction in North London.—The Directors of the Gas Light and Coke Company announce that the price of gas in the district north of the Thames will be reduced from 1s. 2d. to 1s. 1d. per therm (equivalent to a reduction of about 5d. per 1000 c.ft.) as from the date of recording the meter-indices for the December quarter.

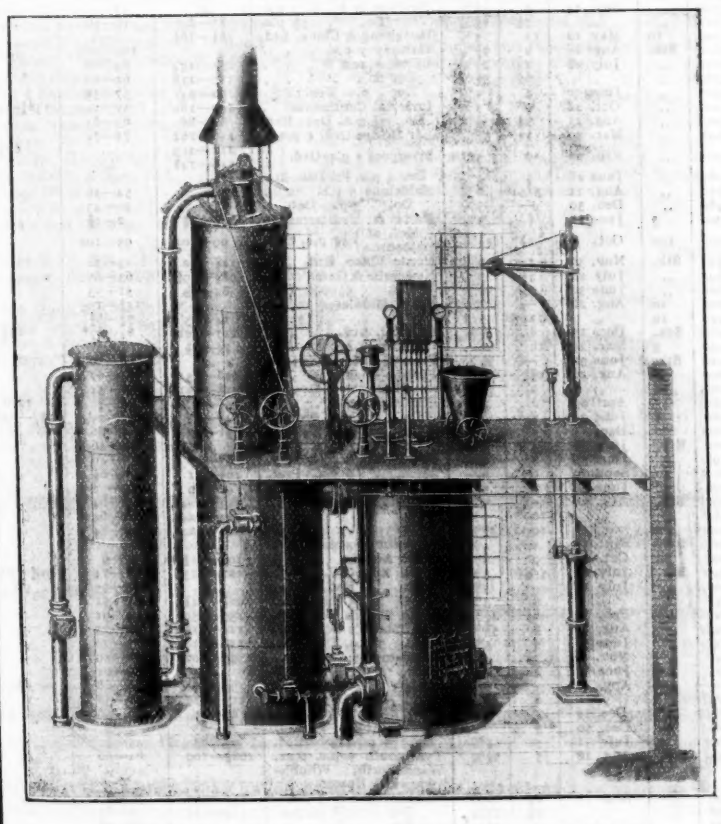
Rugeley Gas Order.—The Rugeley (Staffs.) Gas Company are applying for an Order to enable them to supply gas by thermal units. The standard price now authorized in respect of the supply of gas in the Rugeley area is 4s. 3d. per 1000 c.ft., and the price which the Company have asked the Board of Trade to substitute for this is 1s. 10d. per therm.

Theft of Gas at Glasgow.—John Carr, jun., was charged at the Southern Police Court with having, between Nov. 5 and Dec. 5, at his father's house in Wolseley Street, Oatlands, stolen 3200 c.ft. of gas. To this he pleaded guilty. It was explained that Carr had fixed a branch connection to the main gas supply-pipe, in such a manner as to obtain gas not recorded by the meter. Bailie Nicol imposed a fine of three guineas, with the option of 30 days' imprisonment.

A Lower Price at Ipswich.—There is to be a reduction by the Ipswich Gas Light Company of three-fifths of a penny per therm (equal to 2·7d. per 1000 c.ft.) in the price of gas, to take effect from the reading of the meters for the Christmas quarter. The new price will be 11·4d. per therm (equal to 4s. 3·3d. per 1000 c.ft.). Instead of altering the rate to prepayment consumers, they will receive the reduction in the form of a cash rebate, payable at the end of each quarter.

Cashel Gas Supply.—At a meeting of the Cashel (co. Tipperary) Urban Council, Mr. R. English called attention to what he considered the inferior quality of gas supplied in the town, and Mr. Hanly (the lessee of the Gas-Works) replied that he was only bound to give light for incandescent burners, and that a satisfactory light could only be obtained if consumers gave notice to have the burners attended to. It was contended that Mr. Hanly was not strictly observing his agreement with the Council, and, after a long discussion, it was decided that he should be given a month to remedy matters, otherwise the Council would take such action as they might be advised.

Spalding Gas-Works.—For the past year, according to the report of the Gas Manager (Mr. R. J. Calderwood), the Spalding coal bill was increased slightly over £2679; and the employees received an advance of wages equal to 15 p.ct. on old rates of pay. The Council have adopted a sliding-scale of additional discount to all large consumers. During the year 4386 tons of coal were carbonized; the total cost of the coal being £10,083, or an average of £2 5s. 2d. per ton, as against £1 14s. 8d. for the preceding year. The quantity of gas manufactured was 63,462,500 c.ft., and the make of gas per ton of coal carbonized 14,469 c.ft. The gas sold per ton of coal was 12,314 c.ft.—an increase of 212 c.ft. Residuals sold realized £4117. There has been an increase in prepayment meters. The Council have expressed approval of Mr. Calderwood's first year's record.



DEMPSTER'S PLANT FOR LIGHTLY CARBURETTED WATER GAS.

DEMPSTER'S
COMBINATION OF
BLUE AND
CARBURETTED
WATER GAS
PLANTS

THE BEST FOR
EFFICIENT
AND ECONOMIC
RESULTS.

R. & J. DEMPSTER, LD.,
GAS PLANT WORKS,
MANCHESTER.

Telephones: 54 and 2296 CENTRAL.
LONDON TELEPHONE: VICTORIA 7436.

Reduction in Price of "N.B.C." Lubricating Oils.—The National Benzole Company, Ltd., announce important reductions in the price of "N.B.C." lubricating oils. With packages free and non-returnable, the following is the new retail price list: 40-gallon barrel—Light, 4s. 8d. per gallon; medium, 5s. 5d.; and heavy, 5s. 11d. 5-gallon drum—Light, 5s. 1d. per gallon; medium, 5s. 10d.; and heavy, 6s. 4d. 1-gallon tin—Light, 6s. 11d. each; medium, 7s. 5d.; and heavy, 8s. 2d. ½-gallon tin—Light, 4s. 7d. each; medium, 4s. 11d.; and heavy, 5s. 4d.

Messrs. Drakes Ltd., of Halifax, have secured a contract for one of their vertical retort installations for the Kildwick Parish Council.

The death has occurred, at the age of 87, of Mr. Joseph Mountain, who for over fifty years was a street lamplighter in the employ of the York Gas Company. It has been calculated that during his lamplighting duty he walked 127,750 miles, and lighted and extinguished 1,500,000 lamps.

A verdict of accidental death was returned by a Belfast Coroner's Court in the case of Philip Smith, aged 64, of Princess Street, who was found dead in bed as a result of gas-poisoning. It was found that the gas-stove had been left turned on in the room, evidently unknown to deceased.

The Bradford Corporation Gas Committee have given the Engineer (Mr. Charles Wood) facilities, with an allowance not exceeding £100 for any necessary expenses, for an expected conference in Bradford, during February, of gas undertakers of the Yorkshire district, in connection with the British Commercial Gas Association.

At an inquest at York on Dorothy Charlton, the young wife of a solicitor's clerk, who was discovered dead by her husband in front of a gas-fire in her bedroom, it was stated that she was in the habit of lying before the fire. When found she was wrapped in an eiderdown quilt. The window was open; but the gas-tap was turned on. A verdict of "Accidental death" was returned.

STOCK MARKET REPORT.

THE general tone of the Stock Exchange last week was good, though one or two dull intervals occurred now and then, and the close was quite comfortable. The gilt-edged market enjoyed strong support—investment money being plentiful.

Home Government issues were in fine case, and scored remarkable advances. Friday's figures for the big four were: Consols 49⅜ 50⅜, War Loan 90¾-91, Funding 74½-74½, Victory 79⅝-80. Bonds and new Colonials shared in the rise, and the new Indian loan succeeded.

Home Rails were rather unsteady; but prices were in strong demand. Canadians were fair; but Argentines were out of favour.

The Foreign Market fluctuated. French, Chinese, and Japanese had some good turns, and Russian once more came into notice.

In the Miscellaneous Market, Rubber and Oil were rather dull; but Textiles, Iron and Steel, and Breweries, were wanted.

Business in the Gas Market was on a quieter scale than in the week before; the bulk of it being in the two big London companies. The paucity of transactions in those of lesser size arises apparently from the proprietors holding on tenaciously to their shares. Many quotations made further advances; the three London Companies leading the way. In the Suburban and Provincial group, Brentford "A" and "B" rose 3 each, ditto debenture 2, Brighton and Hove original 3, British debenture 1, Plymouth and Stonehouse 3½, South Suburban, Southampton, and Tottenham debenture 1 each. Imperial Continental was steady and unchanged. Primitiva debentures rose 1.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 50⅝, 51, 51½, 51⅝, Brentford "B" 75½, Buenos Aires debenture 44, 44½, Commercial 4 p.ct. 58, European 6 5/16, 6⅜, Gas Light ordinary 65⅝, 66, 66½, Imperial Continental 138½, 139, 139½, 139⅝, 140, 140½ (and ditto "exceptional" 100), Primitiva preference 38s. 6d., South Metropolitan 70⅜, 71½, 71⅝, 72, ditto 6½ p.ct. debenture 103, 103½, 103¾, Tottenham "A" 68, ditto 6 p.ct. mortgage 92, 92½. On Tuesday, British 24, Commercial 4 p.ct. 60, Gas Light ordinary 66½, 66⅝, 66¾, 66⅝, 66⅞, 67, 67⅛, 67¼, 67⅜, 67⅝, Imperial Continental 139, 140⅛ (and ditto "exceptional" 112½), Primitiva preference 38s., South Metropolitan 70¾, 71½, 72, 72¼, 72½, ditto 6½ p.ct. debenture 103¼, 103½, 104, Aldershot 5 p.ct. "A" 61½. On Wednesday, Gas Light ordinary 66½, 66⅝, 67, 67⅛, 67¼, 67⅜, ditto maximum 50, 50¼, Imperial Continental 139, South Metropolitan 71, 72, 72½, 73, Aldershot 5 p.ct. "A" 62. On Thursday, Bombay 3¼, Buenos Aires debenture 44, Brighton and Hove ordinary 95½, 96, Continental Union 21, Gas Light ordinary 67, 67⅛, 67¼, 67⅜, 67⅝, ditto maximum, 50, 50⅛, Imperial Continental 138½, 139, 140⅛, Oriental 83⅜, Primitiva 12s. 6d., ditto preference 38⅝, South Metropolitan 72½, 73, ditto 6½ p.ct. debenture 103¼, Barnet "A" 111, 111¾, ditto "D" 68, 69. On Friday, Alliance and Dublin 61 1/16, Brentford "A" 77, ditto "B" 78, Gas Light ordinary, 67¼, 67⅜, 67⅝, 67¾, 67⅞, ditto maximum 49⅞, 50, 50⅛, ditto debenture 51, 51⅛, Liverpool 69⅞, South Metropolitan 73, 73⅛, ditto preference 96, ditto 6½ p.ct. debenture, 104½, Hornsey 5 p.ct. preference 72.

In the Money Market, the easy conditions which characterized the previous week continued without any change, or any sign which would indicate that the close of the year was so near at hand. Discount rates were similarly circumstanced. Silver was very variable, with sharp rises and falls; but the closing figure was 35 5/8d. The Bank rate is 5 p.ct., as fixed on Nov. 3.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issues.	Shares.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAMES.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Aug. 26	4	4%	Aldershot 4 p.c. Pref. .	...	50—55	...
1,551,868	,,	Oct. 13	2½	3 1/2%	Alliance & Dublin Ord.	59—64	50—53	50⅛—51⅛
574,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	46—51	...
280,000	5	Nov. 30	7½	4/-	Bombay, Ltd.	5½—6½	2½—3½	3½
100,000	5	Aug. 11	16	4/7½	Bournemouth Gas and Water { 5 p.c. . .	...	72—81	...
383,110	10	,,	7	7/-	{ B 7 p.c. .	13—13½	8½—9½	
115,000	10	,,	6	6/-	{ Pref. 6 p.c.	13½—14	7½—8½	
162,065	—	June 30	—	4%	{ 4 p.c. Deb.	...	54—59	...
992,045	Stk.	July 15	14	56/-	Brentford A Consolid. .	261—266	75—80	77
734,920	,,	,,	11	55/-	Do. B New .	204—209	73—80	75½—78
55,000	,,	,,	5	5%	Do. 5 p.c. Pref. .	109—111	68—72	...
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb. .	91—93	57—59*	...
214,775	,,	Aug. 26	11	10½%	Brighton & Hove Orig. .	208—213	130—135	...
244,200	,,	,,	8	7½%	Do. A Ord. Stk.	134—139	92—97	95½—96
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max. . .	...	...	
550,000	20	Sept. 29	12½	10%	British	44—45	23—25	24
120,000	Stk.	June 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	56—59	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	43—46	44—44½
100,000	10	May 27	—	6%	Cape Town & Dis., Ltd.	1½—2½	6½—7½	...
100,000	10	Oct. 28	—	4½%	Do. 4½ p.c. Pref. .	4—6	4½—5½	...
100,000	Stk	June 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	53—58	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord. . .	108—110	...	...
1,513,280	,,	July 28	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	57—62	58—60
560,000	,,	,,	5½	38/4	Do. 3½ p.c. do.	103—105	55—60	...
475,000	,,	—	5	5%	Do. 3 p.c. Deb. Stk.	69½—71½	43—46*	...
800,000	,,	Dec. 15	4	—	Continental Union Ltd.	76—79	19—21	21
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	33—38*	...
51,600	,,	Aug. 26	15	15%	Croydon A 10 p.c. . .	...	160—165	...
278,400	—	,,	12	12%	Croydon B and C 7 p.c.	...	125—130	...
492,270	Stk.	—	6	4½%	Derby Con. Stk. . .	125—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk. .	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd. . . .	17½—18	6½—7	6 5/16—6⅝
16,398,975	Stk.	Aug. 11	4/17/4	46/8	Gas { 4 p.c. Ord. . .	98—102	66—68	65⅛—67⅛
2,600,000	,,	,,	3½	35/-	Light { 3½ p.c. max. .	76—79	48—51	49⅛—50⅛
4,062,235	,,	,,	4	4%	and { 4 p.c. Con. Pref.	96—99	62—64	...
4,674,850	,,	Dec. 15	3	3%	Coke { 3 p.c. Con. Deb.	72½—74½	50—52*	51—51½
130,000	,,	Dec. 11	10	10%	{ 10 p.c. Bonds. .	...	...	...
82,500	,,	Sept. 14	5	3½%	Hastings & St. L. 5 p.c.	...	48—50	...
258,740	,,	,,	3½	2½%	Do. 3½ p.c.	87—89	38—40	...
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16¾	5—6	...
86,600	Stk.	Aug. 26	9	9½%	Hornsey 7 p.c. . . .	...	100—105	...
131,000	,,	July 28	7½	7½%	Ilford A and C . . .	151—154	84—86	...
65,780	,,	,,	6½	5½%	Do. B	115—118	61—63	
65,500	,,	June 30	4	4%	Do. 4 p.c. Deb. . .	92—94	57—59	
1,976,000	,,	Oct. 28	9	5%	Imperial Continental .	150—160	137—142	138½—140½
1,255,000	,,	Aug. 11	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	83—85	
235,242	,,	Mar. 30	6½	5½%	Iron Bridge Ord. 5 p.c. .	119—121	72—74	...
2,498,903	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A.	211—213	...	69½
					{ B.	146—148	...	
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Aug. 11	7/5/6	6%	Maidstone 5 p.c. . .	...	54—56	...
63,480	,,	Dec. 30	—	3%	Do. 3 p.c. Deb. .	...	40—43	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4½—4¾	2—2½	...
250,000	100	Oct. 3	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	93—100	...
541,920	Stk.	Nov. 30	4	6%	Monte Video, Ltd. . .	11½—12	53—58	...
1,875,892	,,	July 28	4½	3%	Newcastle & Gateh'dCon.	98½—99½	63—65	...
529,705	,,	June 30	3½	3½%	Do. 3½ p.c. Deb.	82—83	51—53	...
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	...	12½—13½	...
35,940	10	,,	7/14/0	5/3	,, ,, 7 p.c.	14—15	7½—8½	
300,000	Stk.	Dec. 15	8	8%	Oriental, Ltd. . . .	117—122	84—87*	83⅜
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7⅝	2—3	...
188,120	Stk.	June 30	—	3½%	Plym'th & Stoneh'se 5 p.c.	...	68—70	...
60,000	50	Aug. 26	13	60/-	Portsea Island, B . .	128—131	64—67	...
100,000	50	,,	12	55/-	Do. C . .	118—121	51—54	
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	⅛—¼	12/6
499,960	5	June 26	5	—	Do. 5 p.c. Pref. .	4½—5	1 1/16—2 1/16	38/—38/6
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb. .	91—93	64—66	...
600,000	Stk.	July 28	4	4%	Do. ,, ,, 1911	...	43—46	...
346,198	,,	June 30	4	4%	River Plate 4 p.c. Deb.	85—87	43—46	...
150,000	10	Sept. 29	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	6—6½	...
125,000	50	June 30	5	5%	{ 5 p.c. Deb.	47—49	35—38	...
135,000	Stk.	Aug. 26	10	5%	Sheffield A	225—234	62—64	...
209,984	,,	,,	10	5%	Do. B	222—224	62—64	...
525,300	,,	,,	10	4½%	Do. C	220—222	62—64	...
133,201	Stk.	Sept. 13	4	4%	Shrewsbury 5 p.c. . .	...	...	...
90,000	10	Oct. 28	9	8%	South African	10½—11½	7—9	...
6,609,893	Stk.	July 28	5/4/0	5%	South Met. Ord. . . .	111—113	71—74	70½—73½
250,000	,,	July 14	—	5%	Do. Red. Pref. .	...	93—95	96
1,895,443	,,	,,	5	5%	Do. 5 p.c. Deb. .	72½—74½	49—51	...
224,820	,,	Feb. 25	8½	4½%	South Shields Con. Stk.	137—139	89—91	...
1,087,795	,,	Aug. 11	6	5½%	S'th Suburb'n Ord. 5 p.c.	114—116	72—75	...
368,837	,,	June 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	73—76	...
647,740	,,	Nov. 16	7½	5%	Southampton Ord. . . .	99—102	56—59	...
121,275	,,	June 30	4	4%	Do. 4 p.c. Deb. Stk.	...	59—61	...
120,000	,,	Aug. 11	—	6%	Tottenham { A 5 p.c. .	135—138	66—68	68
782,275	,,	,,	6	4½%	{ B 3½ p.c. .	113—117	56—58	...
181,235	,,	Dec. 15	4	4%	District { 4 p.c. Deb.	87—89	53—56*	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Aug. 26	5	3½%	Tynemouth 5 p.c. max.	108½—109	64—66	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Aug. 11	8½	66/3	Wandsworth A 5 p.c.	151—156	78—80	...
255,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	59—61	...
108,075	,,	,,	—	46/4½	Do. C	...	36—38	...
140,865	,,	,,	—	46/4½	New Ordinary	...	37—39	...
352,000	,,	,,	6½	45/-	Wimbledon 5 p.c. . .	117—122	33—35	...
98,000	,,	,,	6½	50/-	Epsom 5 p.c. . . .	121—126	36—38	...
88,416	..	June 30	3	3%	3 p.c. Deb. Stk. . .	66—69	44—47	...

* Ex Div.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 14.]

Nos. 32,506 to 33,279.

AIRD, K.—"Water-heaters." No. 33,124.
ARMITAGE, L. R.—"Toasting-appliance for gas-fires." No. 32,967.
BARRELLE, A. H. B.—"Coke-ovens." No. 33,166.
BATEMAN, H. L.—"Production of heating, lighting, &c., gas." No. 33,178.
BOYS, C. V.—"Means for measuring and delivering gas at a known rate." No. 32,728.
CHAZARD, H.—"Gas-radiator." No. 33,111.
CUMMINS, T. F.—"Couplings or joints for pipes, &c." No. 33,176.
DOLPHIN, J.—"Gas, &c., burners." No. 33,071.
DUFF, J. R.—"Gas-generating plant." No. 32,906.
HEALY, J.—"Suction-gas plant." No. 32,915.
HICKINBOTHAM, S. S.—"Pipe couplings." No. 33,232.
HOWLETT, M., & Co., LTD.—See Dolphin, J. No. 33,071.
HUTTON, J.—"Gas or oil turbines." Nos. 33,140-1-2.
LEE, E. M.—See Armitage, L. R. No. 32,967.
MILLS, H.—"Pipe connections, &c." No. 32,980.
PARTRIDGE, W. J.—See Mills, H. No. 32,980.
POULTON, F. C.—See Cummins, T. F. No. 33,176.
SCHOLAK, V.—See Chazard, H. No. 33,111.
SIERRA, J. M.—"Separation of solid particles from air or gases." No. 32,969.
SMITH, S.—"Gas-stoves." No. 32,937.
TRADE, SECRETARY OF THE BOARD OF,—See Boys, C. V. No. 32,728.
WILDBORE, J. E.—"Incandescent gas-burners." No. 33,038.
YEADON, J. A.—"System of low-temperature carbonization." No. 32,546.

Alderman Dewhurst has been elected Chairman of the Accrington District Gas Board for the eighteenth time. In returning thanks, he said that since Mr. A. J. Harrison (the Gas Manager) came to the town, many changes had taken place in their methods of manufacturing gas; and within the next twelve months they would have the new gas-works in operation. At present they were making gas there experimentally. He thought that in the near future they would prove that, in what Mr. Harrison had done, they spent money wisely and well.

On Saturday, the 3rd inst., the staff of Messrs. R. & J. Dempster, Ltd., were entertained at a dinner and dance at the Midland Hotel, Manchester. All the Directors, together with their wives, were present; and during the dinner the toast of the firm was proposed by Mr. J. W. Scott, and responded to by Mr. Robert Dempster. The other toasts were the Chairman, proposed by Mr. H. S. Knight, and responded to by Mr. Charles Dempster. The dancing was interspersed with musical items—some given by a glee party formed by members of the staff. A very successful and enjoyable evening was spent.

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